THE IMPACT OF CONTRACT FARMING ON INCOME: A CASE STUDY OF NORTHERN LAOS

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ABSTRACT

Title of Thesis	The Impact of Contract Farming on Income: A Case Study of Northern Laos
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The purposes of this study are: (1) to explore the relevant factors that affect a household' decision making with regard to entering into contract farming; and (2) to analyze the impact of contract farming on income per adult equivalent.

The sample consisted of 1,198 observations in the northern provinces of Laos People's Democratic Republic, namely Bokeo, Luangnamtha, and Phongsaly, during 2009 to 2013, based on secondary data obtained from the Northern Rural Infrastructure Development Sector Project (NRI). Key factors that influence household farmers to participate in contract farming were properly evaluated by the random effects of logit and probit models whereas, the fixed effects model were used for evaluating the impact of contract farming on farm income per adult equivalent.

The results of these analyses showed that the following factors have a significant positive relationship with the rate of participation of households in contract farming: Tibet-China households, a smaller share of irrigated land, a larger farm size, and being a shorter distance between the provincial office and the village office. In contrast, households residing in Bokeo and Luangnamtha provinces result in a decrease in the probability of participating in contract farming.

The study reaffirms that, on average, contract farmers earned higher income per adult equivalent compared to non-contract farmers. The higher education attained by the head of household, a larger share of irrigated land, a larger farm size, the household

had access to electricity, and Bokeo households had positively affected farm income per adult equivalent.

Therefore, the results from this study reaffirmed that the Lao government can support households to participate in contract farming by targeting groups where households are a part of the Tibet-China group, have a smaller share of irrigated land and larger farm size, and reside in the Phongsaly province. Specifically, the government should have provincial officers distribute information about contract farming to these groups to raise awareness and increase the rate of participation in contract farming. Doing this may directly help alleviate some of the problems associated with poverty in three provinces in northern Laos.

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Chindalath Phommanilath

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Lao People's Democratic Republic (Lao PDR) has had a gradually increase in the nominal Gross Domestic Product (GDP) growth rate in recent years with an average of 5.8% in 2000, rising to 7.4% in 2015. Furthermore, the nominal GDP growth rate was 6.5% in 2005 before reaching a high nominal GDP growth rate of 8.6% in 2006, due to the vast inflow of foreign direct investment (FDI) into the hydropower and mining sectors. After 2006, nominal GDP growth rate fluctuated during the period from 2007 to 2015 (see Figure 1.1).

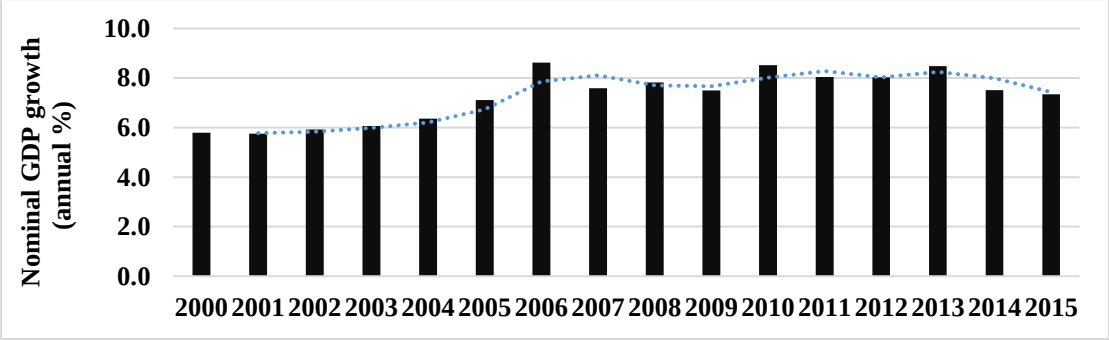

Figure 1.1 Annual nominal GDP growth rate of Lao PDR from 2000 to 2015
Source: World Bank, 2016.

However, Figure 1.2 shows that the real GDP per capita was low in comparison to real GDP per capita of developed countries. This led to Laos being classified as a lower middle-income country by the World Bank (World Bank, 2016). As a result, the ultimate goal of the Lao government is to attempt to be declassified as a lower middle-income country by 2020.

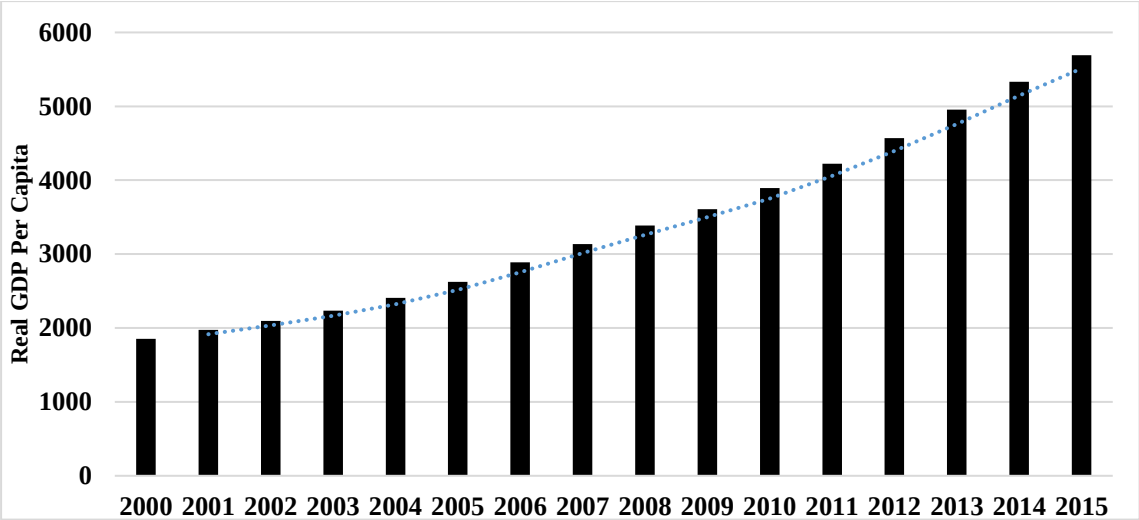

Figure 1.2 Real GDP per capita of Lao PDR from 2000 to 2015

Source: World Bank, 2016.

Lao PDR's economy is divided into three main sectors: agricultural, industrial and service sectors (Lao Statistics Bureau, 2014). The agricultural sector share of the real GDP has declined from 56% to 28% during 1995 to 2014. In contrast, the industrial sector shares of real GDP dramatically increased from 25% to 41% from 1995 to 2014, with the hydropower sector contributing 44.78% and mining sector 14.49% of the real GDP value added (see Figure 1.3).

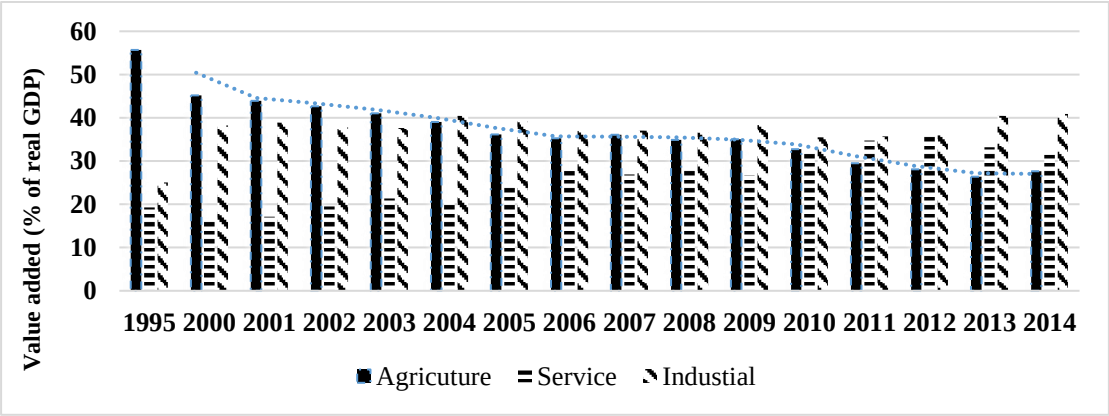

Figure 1.3 Percentage of value added as a percentage of GDP of agricultural, industrial and service sectors from 1995 to 2014

Source: World Bank, 2016**.**

Although the agricultural sector share of the real GDP has had a dramatic decline in recent years, as shown in Figure 1.3, Figure 1.4 shows that a large share of Lao PDR's labor force was employed in agriculture in comparison with the industrial and service sectors from 1985 to 2014. Furthermore, 70% of the Lao PDR's population depends on agriculture for their income compared with 20% of the service sector and 10% of industry, respectively, in 2014. Clearly, development in the agricultural sector will result in the improvement of living standards in the future.

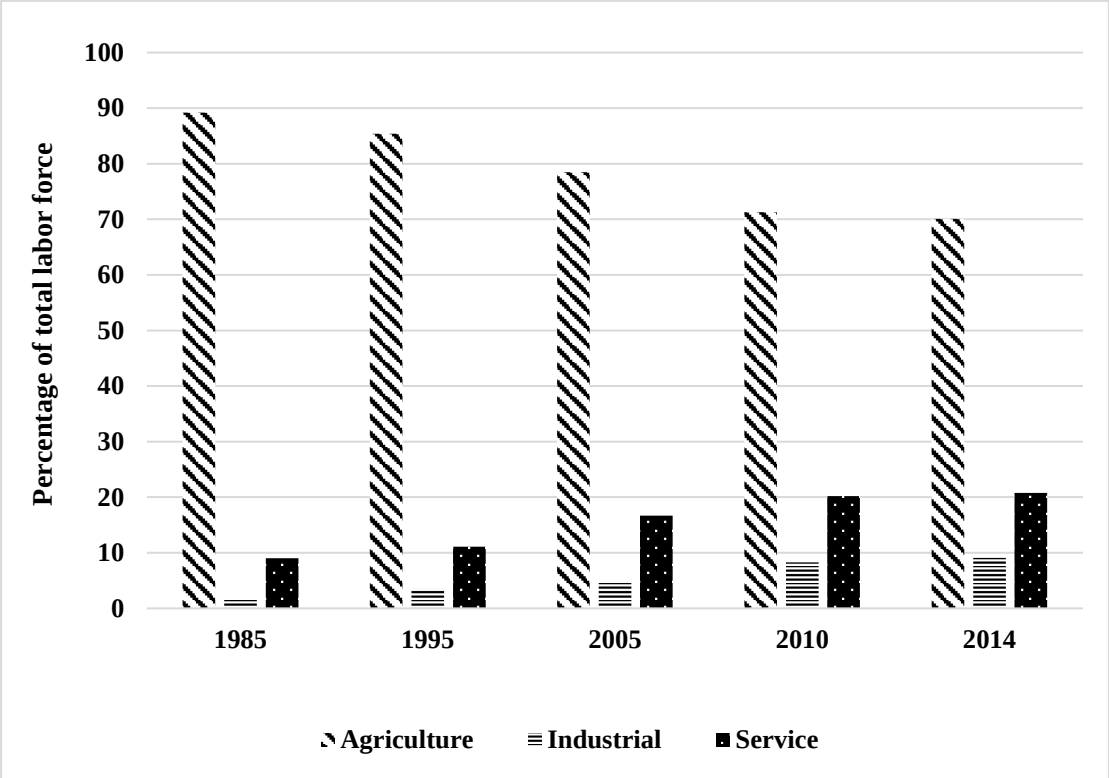

Figure 1.4 Percentage of the labor force employed in the agricultural, industrial and service sectors from 1985 to 2014

Source: World Bank, 2016.

Rice was the main agricultural product, although its value varied from 2005 to 2014. In 2014, rice was the highest value agricultural product at 38.22%, maize 22.37%, and sugarcane 19.47% (see Figure 1.5).

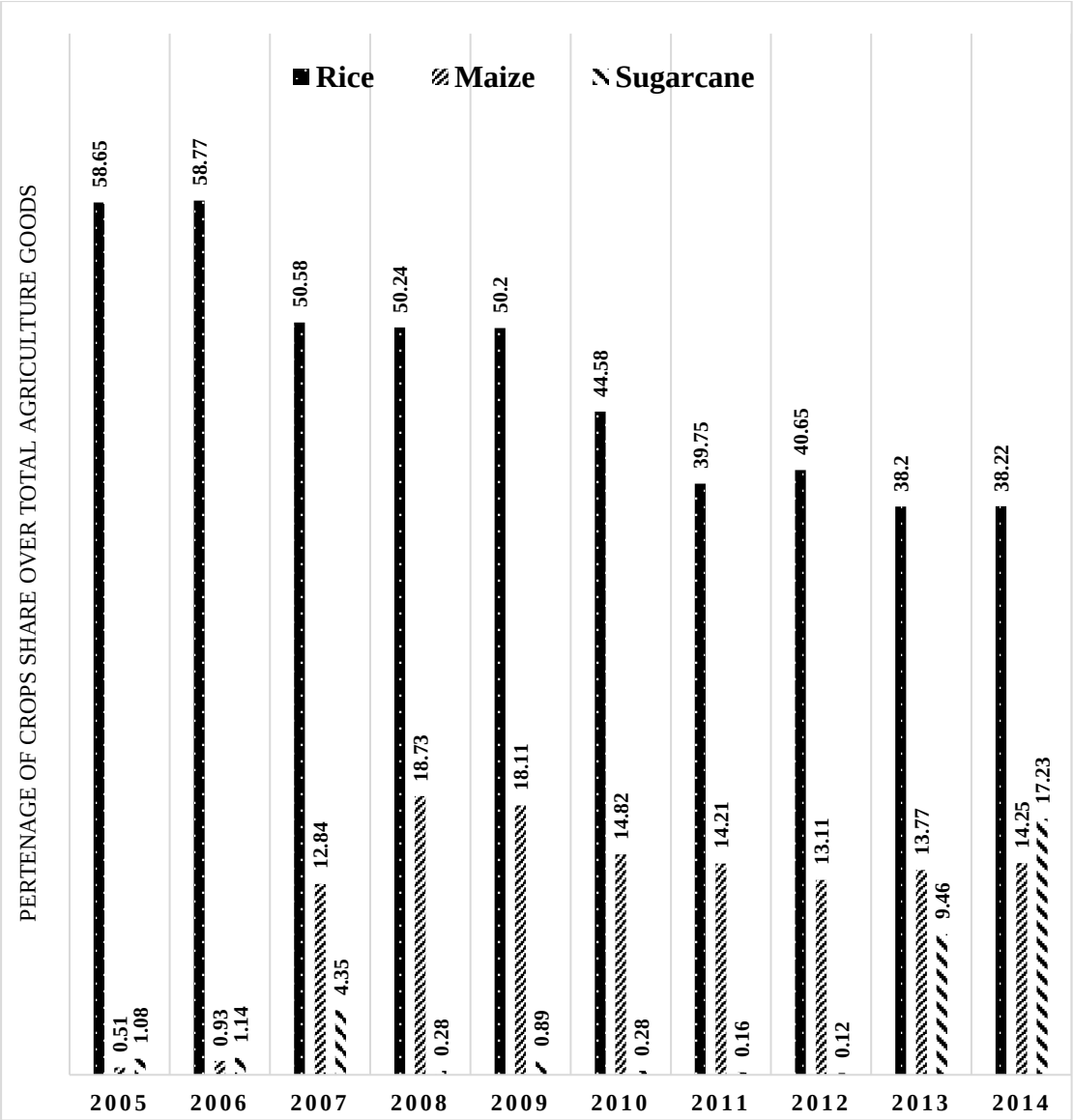

Figure 1.5 Percentage of top three crops compared to all agricultural products in Lao PDR from 2005 to 2014

Source: Lao Statistics Bureau, 2014; Food Agriculture Organization, 2016.

Bokeo, Luangnamtha and Phongsaly provinces are located in the northeast of the country (There are eight provinces in northern Laos: Phongsaly, Luangnamtha, Bokeo, Oudomxai, Luangpabang, Huaphan, Xiengkhuang and Xaiyabury). These three provinces are linked to international markets because of their shared borders with neighboring countries such as China, Vietnam, Myanmar and Thailand (see Figure 1.6).

Figure 1.6 Map of location for Bokeo, Luangnamtha and Phongsaly provinces

Source: The Northern Rural Infrastructure, 2016.

In these three provinces, agriculture is the main source of income. All three province share similarities in terms of top five agricultural products grown which are rice, maize, starchy roots, pumpkin and sugarcane. The top five crops in each province are presented in Appendix A. Sugarcane was the main agricultural products compared to all agricultural products in the three provinces. Its value fluctuated from 31% in 2007 to 30% in 2014, as illustrated in Figure 1.7 (LSB, 2014).

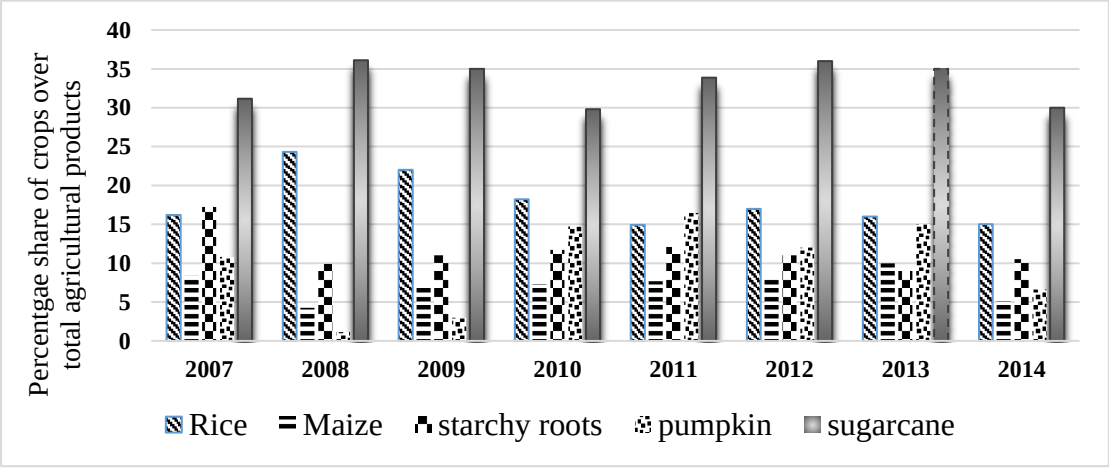

Figure 1.7 Percentage of top five crops compared to all agricultural products in Bokeo, Luangnamtha and Phongsaly provinces from 2007 to 2014

Source: Lao Statistics Bureau, 2014.

The commercial agricultural sector in northern Lao PDR actually experienced a number of difficulties, including limited access to international markets, insufficient market information, financial constraints, and lack of knowledge on how to improve agricultural productivity (Rehber, 2007). Therefore, the level of income of farmers remained low as indicated by 35.2% of the population living below the poverty line, compared to the central provinces (29.8%), southern provinces (22.8%), and Vientiane capital (15.2%) in 2014, as can see on Figure 1.8 (The National Assembly of Lao PDR, 2015).

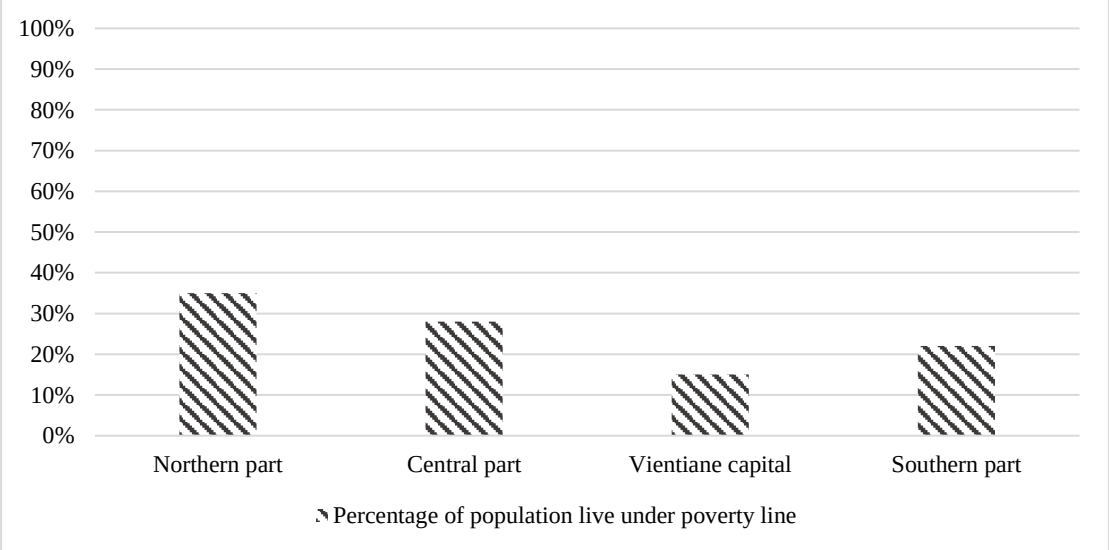

Figure 1.8 Distribution of people living below the poverty line across regions in Lao PDR in 2014

Source: The National Assembly of Lao PDR, 2015.

To escape the poverty, statistics from previous studies done in others parts of the world show that the poverty of some farmers can be reduced through contract farming since it is a fixed contract (verbal or in writing) between two parties (contractor and farmers) made before the harvesting, with the contractor guaranteeing the price of products as well as facilitating inputs, credit, market information or know-how for the farmers. In return, farmers agree to only sell products to the contractor (Hamitton, 2008). Thus, contract farming can help small-scale farmers reduce the risks of farming

in the case of fluctuating market prices, and can help develop market information as well as improve productivity.

Contract farming bring benefits for farmers include increased income, consumption smoothing, modernization as well as access to international markets that can contributed to reduced poverty (Patrick, 2004; Miyata, Minot and Hu, 2009; Erikson, 2011; Bellemare, 2012; Bellemare and Novak, 2014; Valde and Maertens, 2014). However, contract farming may result in losses such as receiving a lower price compared with the market price, inability to access quality standard of outputs (set up by the contractor) because of unfamiliar crops, environmental impacts and increasing debt (Ken and Rusten, 1999; Warning, 2002; Patrick, 2004).

In addition, the literatures review in developing countries during 1998 to 2012 by Prowse (2012) revealed that out of 44 cases, 35 cases resulted in positive benefits for the farmers, whereas, only 5 cases resulted in mixed results, and 4 cases resulted in negative benefits. Thus, contract farming is more likely to improve a household's standard of living overall. Hence, in the case of Lao PDR, contract farming might be a scheme that will help alleviate some of the problem associated with the poverty.

In Lao PDR, contractors mostly came from neighboring countries (e.g., China, Vietnam, and Thailand) from 2005 to 2011. In 2011, the majority of contractors were the joint ventures between China and Vietnam with a size of 218,000 hectares for rubber in northern part, and the minority of contractor came from the United States with a size of 2,000 hectares for livestock in southern part (see Figure 1.9).

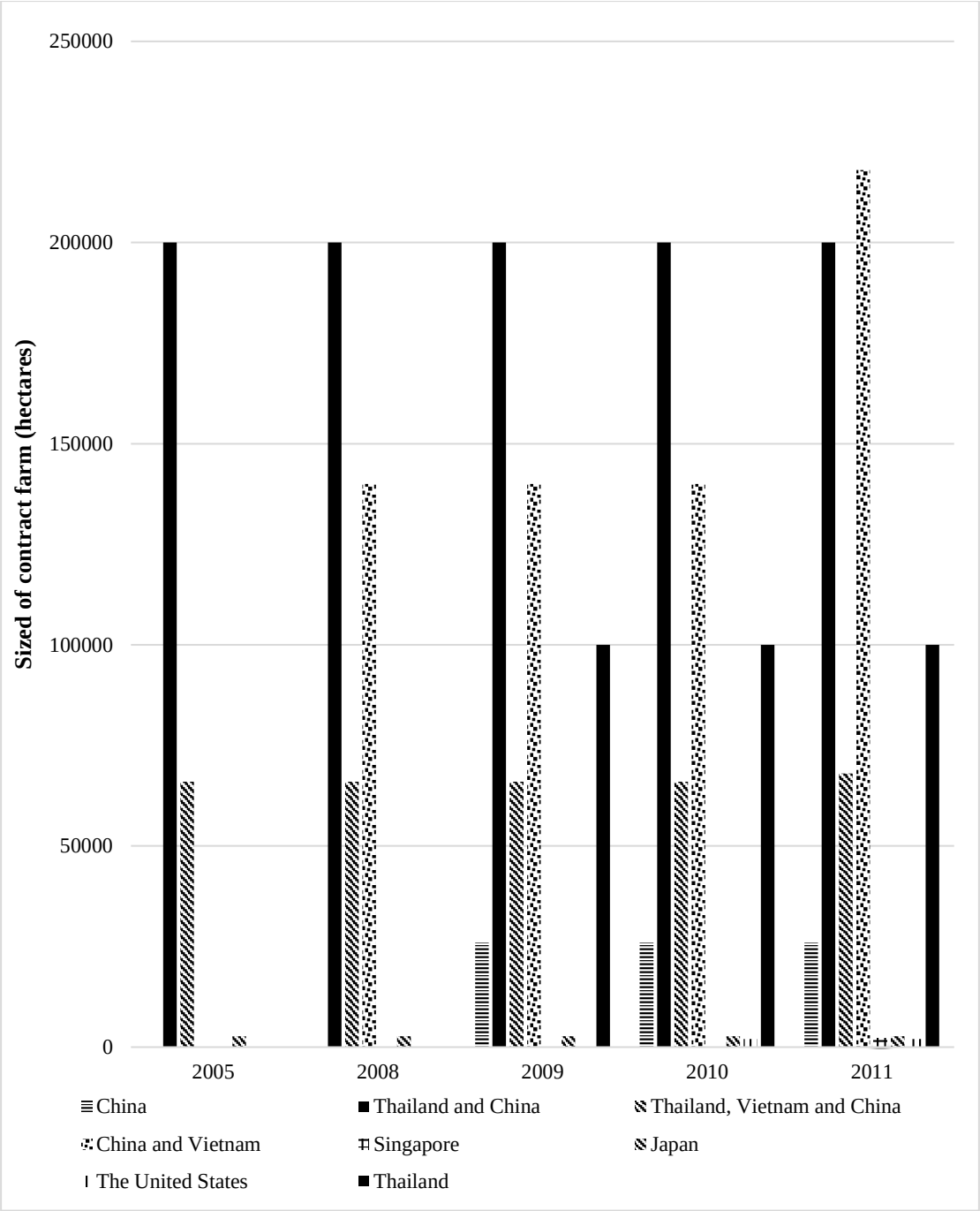

Figure 1.9 Size of contract farms by contractors in Lao PDR from 2005 to 2011
Source: International Institute for Sustainable Development, 2012.

Figure 1.10 indicates the market of contract farming in northern region. The majority of contractors were Chinese and Vietnamese contractors (joint venture) who equaled 55% of total contract farms in northern Laos. Moreover, Figure 1.11 shows all

agricultural crops of contractors in Bokeo, Luangnamtha, and Phongsaly provinces from 2005 to 2011. In 2011, the largest contractor is Dau Tieng Viet-China Rubber Joint Stock Company (a China-Vietnam joint venture) that invested in rubber on 173,152 hectares, Thai and Chinese contractors invested in maize on 66,000 hectares, and Thai, Chinese, and Vietnamese contractors invested in other crops (for instance: rice, tea, watermelon, potato, chili, Indian bean, peanut, and soya bean) in an area of approximately 26,000 hectares in 2011 (see Figure 1.11) (IISD, 2012).

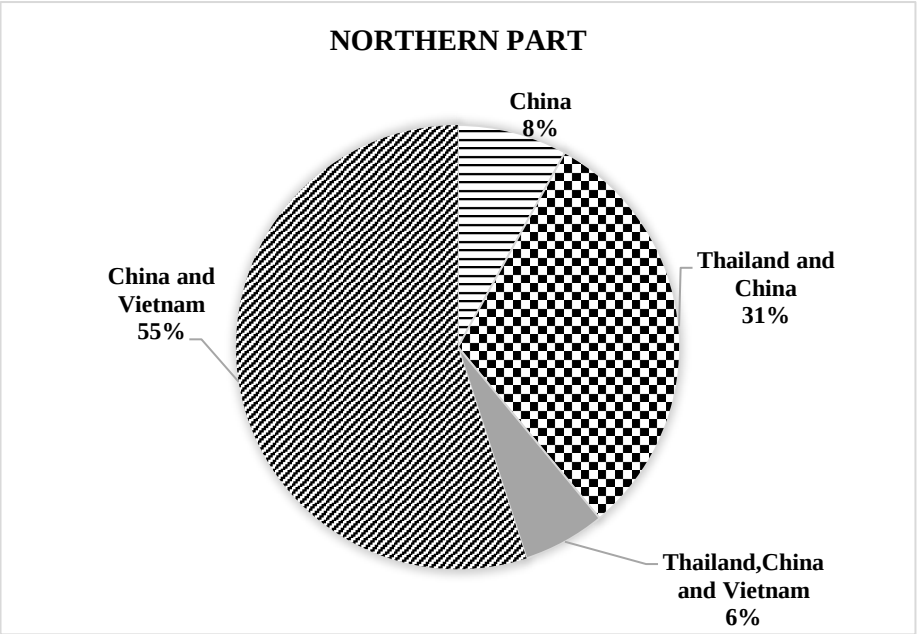

Figure 1.10 Share of foreign contractors in northern region of Lao PDR in 2011

Source: International Institute for Sustainable Development, 2012.

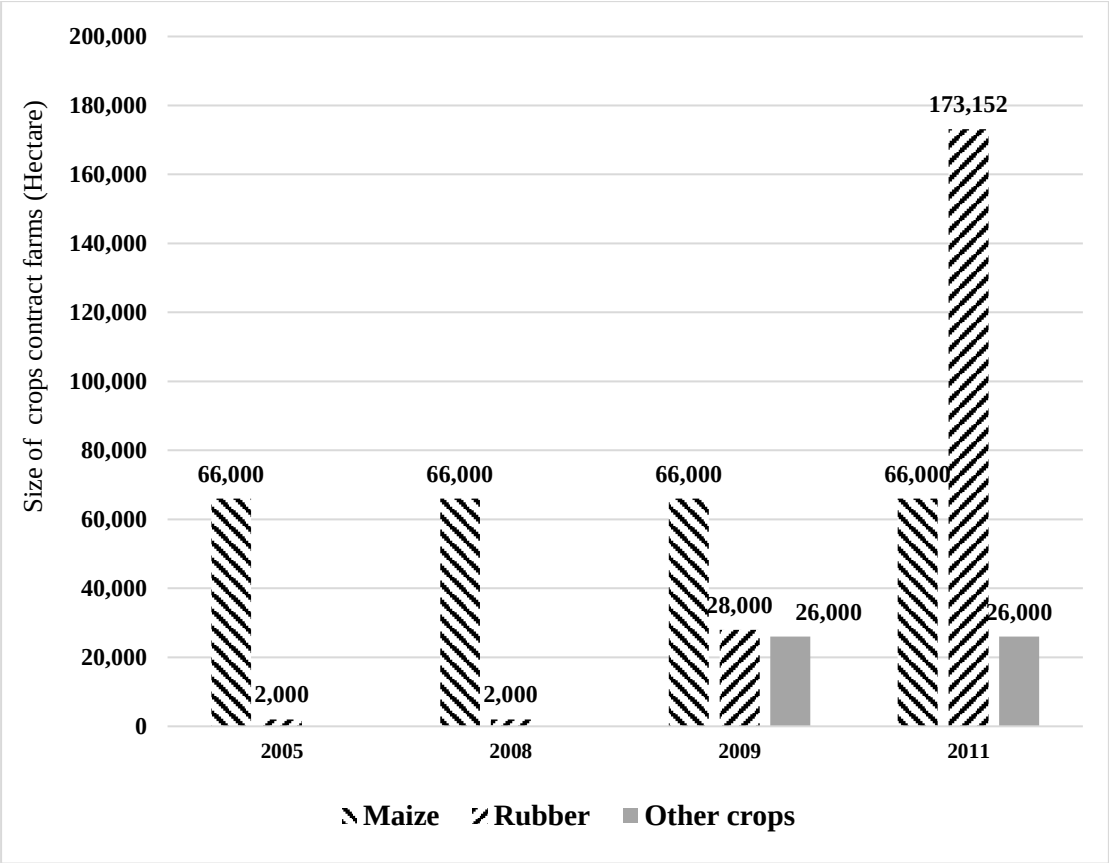

Figure 1.11 All agricultural crops of contractors in Bokeo, Luangnamtha, and Phongsaly provinces from 2005 to 2011

Source: International Institute for Sustainable Development, 2012.

Thus, by assessing the data available from the "Northern Rural Infrastructure Development Sector Project (NRI)" which included statistics on 1,198 observations in Bokeo, Luangnamtha, and Phongsaly provinces, the potential benefit of contract farming could be analyzed to determine whether contract farming is an effective strategy in order to prioritize some ways in which poverty can be alleviated.

This study consists of the following: Chapter 1 provides the introduction, Chapter 2 provides the theoretical and literatures review, Chapter 3 provides the methodology, Chapter 4 provides the results of the study and Chapter 5 provides the conclusion, limitation of the study and recommendation, and policy implication.

1.2 Objectives of the study

1) What are factors having an influence on a household' decision making to participate in contract farming?

2) Does contract farming have an impact on income?

1.3 Benefit of the study

Policy implications for the Lao government in order to support a household to participate in contract farming, if contract farming significantly improves their income.

1.4 Scope of the study

This study gathered secondary data from ADB and Ministry of Agriculture and Forestry in Laos, namely the "Northern Rural Infrastructure Development Sector Project (NRI)" which consisted of 1,198 observations in three provinces in northern Laos: Bokeo, Luangnamtha and Phongsaly during 2009-2013.

CHAPTER 2

THEORETICAL AND LITERACTURES REVIEW

Many studies have focused on contract farming. This chapter is organized according to the following structure: Section 1: types of contract farming in Lao PDR; Section 2: impact of contract farming on income by comparing successful and unsuccessful cases; Section 3: factors that affect households to participate in contract farming; and Section 4: a review of contract farming policies.

2.1 Types of contract farming in Lao PDR

The studies of other authors show that there are five types of contract farming in developed and developing countries (see Figure 2.1) (based on IISD, 2012). The detail of each model in Lao PDR is explained in Table 2.1.

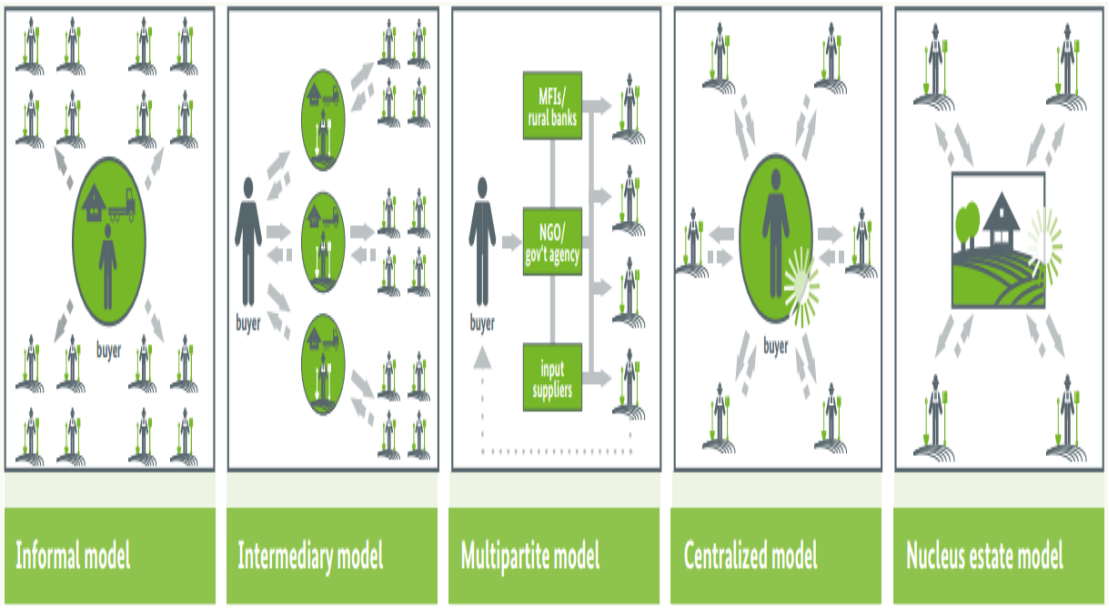

Figure 2.1 Types of contract farming in Lao PDR

Source: Federal Ministry for Economic Cooperation and Development, 2012.

Table 2.1 Types of contract farming in Laos

Types of contract farming	Definition	Size of firms and farmers	Conditions before contract	Type of crops
Informal model	Small contractor will buy the output directly from the farmers by informal contract or verbal contract as in the case of Bokeo, Luangnamtha, and Phongsaly provinces.	The contractor is a small firm with a limited amount of small farmers due to the small scale of contractor.	Farmers have their own equipment such as land or labor. Contractor provides some of the input with low credit.	The crops used in this type of contract are the crops that only take a short time to process such as fruits and vegetables, e.g., rice, tea, watermelons and maize.
Intermediate model	Sub-contractors or the middle men that contact with farmers and sell the output to the main investor or the market that they negotiated with (verbal or formal contract) as in the case of Bokeo, Luangnamtha, and Phongsaly provinces.	The contractor is a small or medium firm. They make a contract with small-scale farmers.	Farmers have their own equipment such as land and labor where the contractors have to provide capital, input, and agricultural equipment or credit for the farmers.	Commodities used in this type of contract are staple food crops, e.g., potatoes, rice and chilies.
Multipartite model	This is formal contract in which the investor has little contact with farmers as management will be by a group of farmers or local staff. The local staffs can be NGOs, Micro Finance Institution.	This type of contract requires medium or large contractors. They make a contract with many small or medium sized farmers.	Contractor provides the input, technology, credit and advice to farmers while farmers have their own land or labor.	The commodities under contract should have high demand from international markets such as maize, Indian bean, peanut and soya bean.

Table 2.1 (Continued)

Types of contracts	Definition	Size of firms and farmers	Conditions before contract	Type of crops
	After that they will contact directly with the main investors who may be unknown to the farmers as in the case of Bokeo, Luangnamtha, and Phongsaly provinces.			
Centralized model	The contractor is the investor that directly makes a contact with the farmer by formal contact as in the case of the Vientiane capital.	The size of firm required large-scale private investors caused by a high fix cost for the firm to supply the farmers with labor, inputs and know-how.	Contractor provides inputs, technology, credit and advice to the farmers while farmers have their own land or labor.	Crop that used as inputs to supply for the industry such as a local sweet corn and fruits.
Nucleus estate model	The contractor is the investor that directly contacts with farmers by formal contact and the contractors control all aspects of the process as well as having their own plantation in order to meet their standard as in the case of Savannakhet.	The size of farmland is quite large and requires the large private contractors due to the fixed cost that firms have to pay for all aspects of production management. The farmer can be small or medium farmers.	The farmers do not need to have their own land as the contractor has their own plantation and input provision for the production process. In some cases, the contractor only needs labor to produce crops.	Commodity used in this type of contract is sugarcane.

Source: Fullbrook, 2007; IISD, 2012; Prowse, 2012; Phommanivong and Ayuwat, 2013.

In the case of Bokeo, Luangnamtha and Phongsaly provinces, the most common types of contracts were informal, intermediate and multipartite models (mostly verbal contracts, and with some informal contracts) (Fullbrook, 2007; Phomvixay, 2016). Informal and intermediate contracts reduce costs for farmers in terms of finding the market or credit for production inputs and reduce the cost for contractors to find a producer.

On the other hand, the rate of default of contracts (by both contractors and farmers) is high (approximately 60 percent) as it is merely a verbal agreement (Phommachak, 2016). Contractors may default on farmers by not buying crops or buying at lower than the market price, while farmers may default by not selling the crops to the contractors due to traders offering higher prices than the contractors. Hence, if type of contract farming was the multipartite model (where the subcontractors can be a local staff, an NGO or an approved micro finance institution, it may be the best means to reduce the number of defaults.

Nevertheless, the limited availability of data from the NRI project means that access to and analysis of households that were participating in different types of contracts, and their correlation to household's income was not possible in the current study. Thus, this study focuses on the impact of contract farming on household incomes in all types of contracts that were applied in the three provinces. In addition, this study gathered the informational interviewing from the Lao government officers in the section 4.3 on chapter 4.

2.2 Impact of contract farming on income

Contract farming has been used before World War II when the United States made contract agreements in vegetable crops in Latin America, and Japan made contract agreements in Taiwan in the nineteenth century (Mighell and Jones, 1963).

As many studies have examined contract farming, this section compares the successful and unsuccessful cases of contract farming as followed: country status (developed and developing countries), agricultural products (fruits, vegetables and animals), types of market, size of firms, and prices used in contracts. The analysis of

characteristics of farmers will do in other part. Finally, this current research will analyze the previous studies for contract farming in Lao PDR.

Successful cases are meant to be cases where contract farming increases the farmer's income significantly. In contrast, unsuccessful cases mean that contract farming reduced their productivity or decreased their income.

Table 2.2 Comparison of the impact of contract farming between successful and unsuccessful cases

	Successful cases	Unsuccessful cases
Country status	Contract farming in developed countries succeeded due to highly effective regulations (based on percentile ranks provided in World Governance Indicators 2009), legal setting and contract creation (Miyata et al., 2009; Bellemare, 2012; Bellemare and Novak, 2014). Developed countries had high demand for agricultural commodities due to the large size of domestic and foreign markets. In developing countries, they succeeded due to strict enforce-ment, the good contract creation and the ease of doing contract documents for private contractors (Prowse, 2012). Additionally, government created incentives for private contractors (especially foreigners) to invest in contract farming. The well-known for the government staffers (mostly village leaders) to vet the potential contractor and contract farmers, are also important factor (Prowse, 2012).	Contract farmers can either increase or decrease income compared to non-contract farmers among developed and developing countries (but contract farming was mostly more likely to improve income in both countries status). In developed countries, contract farming failed to succeed due to ineffective structure contract creation, or even break down of an agreement either by farmers or contractor because they used an informal contract, which it is not strictly adhering to the law (Warning, 2002). In developing countries, contract farmers failed to succeed because of unfamiliar crops, so they are unable to achieve a sufficient quality standard. Contract farmers have a lack of knowledge of structure contract creation, since they had low levels of education.

Table 2.2 (Continued)

	Successful cases	Unsuccessful cases
	Prowse (2012) provided a review of the studies on the impact of contract farming on income among developing countries, during 1998 to 2012. The study showed that out of 44 cases, 35 resulted in a benefit for farmers.	Moreover, the law enforcement is less effective than developed countries. Thus, they failed to succeed in contract farming as in the case of Cambodia (Patrick, 2004). Prowse (2012) showed that out of 44 cases, 5 cases had the mixed results (contract farming resulting in both benefits and loses), and 4 cases resulted in a loss for farmers.
Agriculture products	Crops that have high added value at the global market or urban market, particularly crops that take time to grow as consumers are willing to pay more for premium quality, e.g., fruits, vegetables and animals. For instance: - Rice, green beans, cotton and maize in Madagascar (Bellemare, 2012) - Seed rice in Bali, Indonesia (Patrick, 2004) - Traditional crop chayote in Costa Rica (Sáenz-Segura, 2006) - Tea in Kenya (Mwaura and Muku, 2007) - Apples and green onions in China (Miyata et al., 2009) - Sweet peppers in Thailand (Schipman and Qaim, 2011) - Cassava (Tuan, 2010) - Horticulture in Nicaragua; pineapples in Ghana; and cotton, gherkins, papaya and marigold in India (Barrett, Bachke, Bellemare, Michelson, Sudha and Walker, 2012)	Vegetables and fruits are highly perishable. For instance: - Mexican frozen vegetables in Latin America (Ken and Rusten, 1999) - Oil-peanuts (Waning, 2002) - Peppers in Costa Rica (Sáenz-Segura, 2006) - Sorghum, sunflowers and in Uganda (Elepu and Nalukenge, 2009). Additionally, rice contract farming is also an un-successful case in Cambodia (Cai et al., 2008). This result was not caused by the choice of crop but rather is the result of the structure contract creation.

Table 2.2 (Continued)

	Successful cases	Unsuccessful cases
	- Rice in Benin (Velde and Maertens, 2014). - Poultry in Vietnam, China, and Bangladesh (Tiong, Lapar, Jabbar and Staal, 2009; Wainaina, Okello and Nzuma, 2012; Bequm, Alam, Buysse, Frija and Van Huylenbroeck, 2012).	Finally, poultry chicken in Lambok province, Indonesia also did not succeed because contract farmers generated an increase debt load from credit provided by contractors, the failure did not result from the type of agricultural products only (Patrick, 2004).
Market	The majority of contractors export to markets where consumers have higher purchasing power such as the global market and large urban market, this helps contractors to reduce their high fixed costs and increase profit in comparison to selling to a small market that has a lower consumer base (or lower purchasing power) (Ken and Rusten, 1999; Waning, 2002; Miyata et al., 2009; Bellemare, 2012; Bellemare and Novak, 2014; Mwaura and Muku, 2007; Barrett et al., 2012), and urban market (Patrick, 2004; Sáenz-Segura, 2006; Tiong et al., 2009; Tuan, 2010; Bequm et al., 2012).	The majority of contractors' markets are little different regarding successful cases; for instance, a local urban markets and the small export to target markets. Because those markets having a small consumer base as they are selling in developing countries, so consumers have less purchasing power compared to large urban markets in developed countries. The crops produced under contract farming are not popular, or even having higher price than crops did not produced under contract farming. As a result, only contractors have to bear a high fix cost and having lower profit margin, while contractor farmers still receive a fixed price for crops from contractors, thus the contract farming collapsed (Patrick, 2004; Sáenz-Segura, 2006).

Table 2.2 (Continued)

	Successful cases	Unsuccessful cases
Size of firms and price	The majority firms (contractors) were large private firms that used either fixed price (agreed during contract creation) or spot market price. This may be because a fixed price is higher than a market price at that time thus contract farmers gain a benefit from fixed price contract compared to independent farmers that received a lower price. Moreover, contract farmers also receive a benefit from spot price contract, as they can receive more income when the market price rises (Ken and Rusten, 1999; Waning, 2002; Miyata et al., 2009; Bellemare, 2012; Bellemare and Novak, 2014; Mwaura and Muku, 2007; Barrett et al., 2012; Tiong et al., 2009; Tuan, 2010; Bequm et al., 2012). Finally, contractors that were joint ventures between NGOs/ government institutions and private firms that used cost base price, may be due to the third party involved in the production resulting in farmers having more bargaining power with contractors when they had a problem from structure contract creation. Moreover, government have power to support contractors when exporting crops to the global market (Patrick, 2004; Sáenz-Segura, 2006; Wainaina et al., 2012; Velde and Maertens, 2014).	Size of firms were the same as successful cases. The majority of firms were private firms that established a fixed price during contract creation (Patrick, 2004; Sáenz-Segura, 2006; Elepu and Nalukenge, 2009). This clearly shows that even a contract that has a fix price, could result in a decrease or increase in income, which might be caused by different fixed price set at the creation of the contract. A fixed price in unsuccessful cases may be because they received a lower price than the spot market price (as compared to a fix price in successful cases when they set a higher fixed price than the spot market price) (Prowse, 2012). Contractor is an NGO that used floor price (minimum price), as in the case of Sorghum contract in Uganda. Contract farmers cannot receive a high income from contract farming, which is not caused by the floor price, but by the NGO not having enough skill to give advice to farmers resulting in contract farming failure (Elepu and Nalukenge, 2009).

Source: Author reviewed literatures

There are few investigations into contract farming in Lao PDR and most of them have concentrated on rice in Savannakhet province (Setboonsarng, Leung and Stefan, 2006); organic rice in Vientiane capital (Erikson, 2011); and rubber in Luangnamtha, Oudomxay and Bokeo provinces (Lazar, 2009). These studies have yielded both successful and unsuccessful results.

Setboonsarng et al. (2008) studied rice contract farming in the Vientiane province using Propensity Score Matching to evaluate the impact of contract farming on the livelihood of households. The results revealed that contract farming increases profits, price per kilogram, and yield of rice. Phoumanivong and Ayuwat (2013) used quantitative analysis to evaluate the impact of contract farming on the income of sugar cane farmers in the Savannakhet province. Their results revealed that contract farming had both positive and negative impacts on a household's income. Positive effects include an increase in household income, skill transfer and networking among households that participated in contract farming; whilst some households suffered increased debt and a lack of knowledge when it came to handling chemicals.

2.3 Factors that affect households' decision making to participate in contract farming

Contract farming can result in both benefits and loses to farmers. In order to evaluate the impact of contract farming has on a household's income, the results from previous studies revealed that the factors that affect households to participate in contract farming were determined as follows.

2.3.1 Characteristics of farmer

Family size is a significant indicator of increasing agricultural income, specifically the proportion of adult members in households, as a larger number of members in household normally mean a larger pool of labor use for farming activities which also results in an increase in crop yields as compared with smaller families (Patrick, 2004; Miyata et al., 2009; Bellemare, 2012; Bellemare and Novak, 2014; Velde and Maertens, 2014; Bequm et al., 2012).

The gender of the head of the household is also important. If they are male, there is a higher probability of contract farming participation versus if the head of the household is female. This may be due to males generally having greater physical strength and having little responsibility for the care of the family, especially children, compared to females, in other words, female headed has to share their work both agricultural activity and housework. Therefore, if the head of the household is male, he is more likely to join the contract than female household headed (Wainaina et al., 2012; Bellemare, 2012; Bellemare and Novak, 2014; Valde and Maertens, 2014).

The education level of the head of the household also contributes to their decision to participate in contract farming. Household heads with a higher level of education have a higher level of participation in contract farming since it reduces the cost monitor farmers in farm management for the contractors than uneducated household heads (Wainaina et al., 2012; Tionco et al., 2009; Bellemare, 2012; Bellemare and Novak, 2014; Valde and Maertens, 2014).

On the other hand, household heads with a higher level of education participated less in contract farming because he/she had more opportunities to work outside of the farm or even growing crops without contract farming (because they will have a lack of the independent for growing crops, if they participate in contract farming) as the case of boiler chickens in Indonesia (Patrick, 2004).

Households that had debt were more likely to participate in contract farming because contract farming provides credit for households without collateral. Hence, households with financial constraints or debt participated more in contract farming (Patrick, 2004; Tionco et al., 2009; Schipmann and Qaim, 2011).

Ethnicity also plays a role in agricultural practices. Different ethnics groups have different languages, attitudes and cultures regarding agricultural practices, which lead to differences in income (Strickland and Strickland, 1996; Easterly, 2007; Kamiya, 2011; Andersson, Engvall and Kokko, 2006; Engvall, 2006; Warr, 2006).

In northern Lao PDR, there are four majority ethnicities: Lao-Tai, Hmong-Lumien, Mon-Khmer and Tibet-China (Based on Lao National Assembly decision No. 213 (2008). Lao-Tai farmers speak the Lao language (Sodarak, 1999). A study of Vixathep, Ophanhdala and Paythoune (2013) showed that Lao-Tai farmers tend to be more successful than other ethnic groups because they are mostly located in lowland areas and along the Mekong River where it is more likely to have a good soil (which it could improves productivity) than in upland areas. Moreover, they are knowledgeable on cultivation adoption because they tend to be more educated than other ethnic groups (Sodarak, 1999; Andersson et al., 2006; Engvall, 2006; Warr, 2006).

Due to their norms and values, historical data has shown that people in other ethnic groups: Hmong-Lumien, Mon-Khmer and Tibet-China endure heavy farm workloads when they were children instead of going to school, and these low attendance rates greatly affect adult literacy. In addition to this, Mon-Khmer have a

much lower standard of living than the other three ethnic groups described here (Sodarak, 1999). Moreover, the three ethnic groups are mostly located in upland farming country. Uplands do not have good soil compared to lowland areas, which results in low productivity (Sodarak, 1999). Due to geographical conditions (upland farming), their main source of income came from selling upland rice and non-timber forest products (The Northern Rural Infrastructure, 2013).

Additionally, history suggests that the Tibet-China group migrated from southern China (Sino-Tibetan origin) into northern Laos about 200 years ago (Sodarak, 1999). The majority of contractors in the northern part of Lao PDR came from China and Vietnam at 55%. Therefore, Tibet-China may have a higher chance of participating in contract farming compared to the other three groups.

Farming households have the ability to run a business indicated the extra money used in households for farm activity during unproductive crop periods, which reduces dependence on farm income only. It creates a higher chance for farmers to communicate with traders and increase the ability to access the market to shift from primary crops to commercial products. Business households increase the ability to use more inputs or new technology in farming compared to household that only do farming. Hence, if a farming household runs a business, it contributes to higher productivity in farming compared to households that only do farming (Andersson et al., 2006; Engvall, 2006).

2.3.2 Household assets

Owning land is usually an indicator that a farmer is wealthy. Households who own less land or rent land are typically less wealthy and they are less likely at selecting participate in contract farming as it increase the cost per unit of input used in farm for contractors.

Patrick (2004) used the irrigation land area to indicate the availability of water used in farm activity since households that have access to irrigation have higher productivity and crop yields in the rainy off-season compared to households that cannot access irrigation. Miyata et al. (2009) used the share of irrigated land to total land ratio as a measurement of their ability to access the water. The result of their study found that a higher proportion of irrigated land created more income, and they are more likely to choose entering in contract farming. In contrast, Patrick (2004) suggested that the irrigated land is not necessarily for contractor to consider because incremental water is not ultimate input for growing maize in Indonesia.

A larger area of farm size indicated a higher ability to produce higher crop yields than households that have less farm size. This could help the contractor reduce the cost per unit of input rather than having smaller landowners (Patrick, 2004; Tionco et al., 2009; Schipmann and Qaim, 2011).

2.3.3 Agricultural activity

Farming households that use chemical fertilizer in farming captures the choice of agricultural methods. Chemical fertilizers help farmers received higher yield per hectare, raising productivity in farming, which in return lead to higher income compared to households that do not use chemical fertilizer (Andersson et al., 2006; Engvall, 2006; Warr, 2006).

2.3.4 Access to electricity and health care services

Access to electricity has the beneficial effect on income generation among rural households so that farmers can watch televisions and/or listen to audio equipment (improving farmer' access to advice or information on agricultural farming), and can employ electronic equipment in the farm. It improves the farming productivity and leads to a higher standard of living for a household, especially in rural areas, compared to households that cannot access electricity (Andersson et al., 2006; Engvall, 2006; Warr, 2006). Households that have access to health care services also contribute to higher labor productivity (or improve a laborer's health when they are sick, which contributes to higher income compared to households that do not have access to health care (Andersson et al., 2006; Engvall, 2006).

2.3.5 Location

Road conditions reflect the effect of the quality of infrastructure in village. If households only have access to poor road conditions, it creates an obstacle for farmers to transport and communicate with buyers. Not only does this make it difficult for farmers to access the market, it also prevents them from being able to buy inputs and pesticides. Hence, if households only have access to poor road conditions, it reduces the farming productivity compared to households that have access to good road conditions for all seasons (Andersson et al., 2006; Engvall, 2006; Warr, 2006; Schipmann and Qaim, 2011).

The field survey in current study reported that the village office was the official center for farmers and contractors to meet or exchange information/know-how about contract farming transport crops, with the head of the village being the medium. Moreover, it was also the place for contract farmers to transport crops to the contractor's base. Hence, this study used the distance between village offices to government office (provincial office) to explore whether or not this factor had impact on the decision of farmers to participate in contract farming (NRI, 2013). Furthermore, the longer distance from a farmer' house to a nearest market tends to increase farmer' decision making to participate in contract farming as it is difficult for farmers to access a market (Bellemare, 2012; Bellemare and Novak, 2014).

Geography is also a key consideration during the selection process. Households located close to a contractor's base or bases are more likely to become contract farmers or have a higher probability of a contractor selecting them to become a contract farmer. Tionco et al. (2009) conducted a study in northern Vietnam and found that provincial location, especially provinces closest to contractors, affects a contractor's decision to select household to participate in contract farming. This study will test whether or not province determines farmers' participation in contract farming, specifically for the Phongsaly province, which is located near-China and Vietnam (majority contractors in northern part).

2.4 Literatures review of policy implications for contract farming

Many studies have proposed different policies in order to increase the economic productivity of farmers (raising income). In the contract farming scheme, small-scale farmers (who own a small plot of land) face more barriers, so contractors seem to encourage large-scale farmers to join instead (Miyata et al., 2009; and Tionco et al., 2009). This study will offer recommendations for policymakers based on three points of view: the contractor, the contract farmer, and the government, to direct contract farming towards more sustainable benefits for farmers based on the lessons learned in successful and unsuccessful cases from past studies.

2.4.1 Contractor

Contract farming is a risk shared between contractors and farmers (Bardhan and Udry, 1999). Governmental staff should ensure that contract structure creation is not only based on the contractor's own interests, but also the interests of farmers (Prowse, 2012).

A well-created contract should clearly state the objectives in order to avoid confusion and should draw from the needs of farmers (Elepu and Nalukenge, 2009). For instance, past studies on contract farming showed that input supply uncertainty is an important factor that influences a farmer's decision to participate in contract farming compared to output uncertainty (Abebe, Bijman, Kemp, Omta and Tsegaye, 2013). So, government should encourage the contractors that focused on preventing input uncertainty rather than output uncertainty.

A study conducted by Velde and Maertens (2014) revealed that know-how assistance, input, and credit provision by contractors are also factors that farmers need to consider in order to participate in contract farming because these factors could reduce high fixed costs in farming activity for farmers. Creating contracts based on farmers' needs may encourage more farmers to participate in contract farming.

Cases where contracts failed were often because the crops that were grown were highly perishable and dependent on being delivered within a certain timeframe Therefore, the government can help farmers by encouraging contractors to provide immediate payment to contract farmers who deliver on time. For contract farmers who plant perishable crops, contractors should pay them based on the size of the farm not the yield (Prowse, 2012).

Contract farming can be an effective strategy for local sustainable development through effective management and vertical integration between government and contract farming systems (contractor and farmers) (Begum et al., 2012). The public sector provides infrastructure such as transportation, a wholesale market for contract farming, communication services, and also helps contractors evaluate potential farmers to join the contract (Tionco et al., 2009).

Providing incentives for large, private firms to invest by reducing taxes, lowering interest rates, and giving loans to firms if contract farming effectively raises a household's income (Glover, 1987; Mwaura and Muku, 2007; and Sharma and Singh,

2014). Private sector investment is also influenced by having a fast and efficient way of documents for government staffs to log contracts.

Finally, the government should encourage contractors to allow farmers to take time before making a decision on whether or not participation in contract farming or allow them to renegotiate the contract once they enter into a contract. Government should support this process by providing information about contract farming, and assist both contractors and contract farmers during the contract creation and negotiation stages (Imbruce, 2008).

2.4.2 Contract farmer

Due to budget constraints, the government must seek alternative ways to help farmers such as presenting recommendations to village leaders. Past studies revealed that the majority of small-scale farmers are excluded from participating in formal contract farming because large-scale farmers generate lower cost per unit of input and have a lower risk of default for contractors. However, possessing incremental assets may persuade contractors to choose them (Miyata et al., 2009; Tionco et al., 2009).

The government can help small-scale farmers who cannot join contracts by issuing certificates to those who grow high quality products to help them find traders to purchase their products and facilitate opening the market. Most small-scale farmers are less educated so they have less opportunity to find a job. Issuing government certificates may help reduce some of these problems (Tionco et al., 2009).

Failed cases (or cases in which participation in contract farming did not equate to an increase in income) were caused by the adoption of unfamiliar crops. Past evidence has shown that specialized crops generate higher income than growing a diverse set of crops (Sharma and Singh, 2014). Thus, the government should identify which provinces or locations have the most economies of scale depending on the type of crops in order to help contractors target certain provinces (Glover, 1987; Guo and Jolly, 2009; and Sharma and Singh, 2014).

Forming farmers' groups would help increase their bargaining power (Glover, 1987). However, Elepu et al. (2009) suggested that there was no need to form farmers' groups since contractors are oligopsony or even monopsony that have considerable

market power. Farmers need to be educated enough to be able to analyze the structure contract creation before joining contract farming.

Evidence from the studies show that short-term contracts are not worthwhile for farmers if the crops that they grow take time to harvest. With this in mind, the government should encourage contractors that use a long-term contract to help contract farmers reduce the cost of credit (Narayanan, 2014).

2.4.3 Government

The contract farming structures may not be sustainable without help from a third party or government institutions. A strong regulation from the government is needed for contract farming to work by penalizing parties (both contractor and farmers) who break their contract (Glover, 1987).

A village leader is an important person who closely monitors the relationship between the contractor and farmers (Guo and Jolly, 2009; and Sharma and Singh, 2014). So, the government should work closely with village leaders. A well-educated or well-trained village leader understands the pros and cons of contract farming and can help farmers identify potential contractors and conversely, can help contractors identify potential farmers as well.

Since contractors are seen as oligopoly or monopsony traders, the government should make laws to support a competitive environment in contract farming. This will encourage better contracts that take into account farmers' preferences, not just the preference of contractors, and farmers will be able to choose types of contract farming based on their preferences (Abebe et al., 2013).

Some degree of government intervention is worthwhile, e.g., strong law enforcement, auditing the potential contractor and farmers before joining a contract. Offering incentives to private firms to invest in contract farming helps, but the government should limit the date to subsidize to contractors in order to avoid dependency on government support. The properly incentive policy from the government can generate positive effects such as potentially increasing employment across regions. Again, the government should let the market price adjust the market in order to avoid distortion problems from government policy. Past studies argue that trusting relationships between farmers and contractors directly influence contract

farming participation (Singh, 2002; Cai, Ung, Setboonsarang and Leung, 2008; Elepu et al., 2009).

Finally, cases in developing countries where small-scale farmers benefited from technology transfer or know-how with contract farming because knowledgeable adoption by foreign investors improve their traditional crop productivities (Glover, 1987). As a result, technology transfer from contract farming seems to be one of the most important approaches that governments should consider to improve the standard of living of farmers.

CHAPTER 3

METHODOLOGY

3.1 Empirical models

This study examines the data by using the econometrics approach in order to meet the objectives of the study: (1) to explore factors that affect farmers' decision making with regard to entering into contract farming, (2) to analyze the impact of contract farming on income per adult equivalent.

3.1.1 Factors that affect a household' decision making to participate in contract farming

Part of estimation is the association between dependent and independent variables, which dependent variable is binary variable (0 and 1). Since the binary outcome model estimates the probability that dependent variables equal to 1 as a function of the independent variables, a problem with the linear regression model is that the predicted probabilities will not be limited between 0 and 1. Hence, we cannot use the linear regression model with a binary outcome model.

As a result, logit and probit models can effectively be used to examine the relationships between dependent and independent variables. Logit and probit models have different cumulative distribution function (CDF). Logit model has CDF of logistic distribution and probit model has CDF of standard normal distribution. Thus, this study uses both models to examine the relationships between dependent and independent variables to solve the debate for which is the appropriate model to employ.

To interpret a binary outcome model, we have to estimate the partial marginal effect in order to compute the rate of change of the probability of households to participate in contract farming. Using calculus shows that in the logit model equation the rate of change in probability with respect to an independent variable involves not

only the coefficient but also the level of probability from which the change is measured (Gujarati, 2004).

This study employs a Durbin-Wu-Hausman or Hausman test, to choose the appropriate model between the fixed effects or the random effects of logit and probit models. A Hausman test has a null hypothesis with the preferred model being random effects and an alternative hypothesis being fixed effects (Hausman, 1978). If the probability value is less than 0.05, means that we cannot accept the null hypothesis, making fixed effects a more an appropriate model.

The estimation shows that we cannot reject a null hypothesis because the probability value is equal to 0.9994, which it greater than 0.05 (Prob. > 0.05), so the random effects of logit model is an appropriate model to examine factors that affect households to participate in contract farming (see in Table 3.1).

Table 3.1 A Hausman test – logit model

Correlated Random Effects-Hausman Test Equation: Untitled Test cross-section random effects			
Test summary	Chi-Sq. Statistic	Chi-Sq. d.f	Prob.
Cross-section random	85.22	0.5	0.9994

Source: Author estimated from STATA

Note: Prob. < 0.05 indicate a signification, that is we cannot accept a null hypothesis

Next, a Hausman test of probit model also tests whether the fixed effects or the random effects model is an appropriate model (Table 3.2). The estimation shows that we cannot reject a null hypothesis because the probability value equal to 0.9985, which it greater than 0.05 (Prob. > 0.05), so the random effects of probit model is an appropriate model to examine factors that affect households to participate in contract farming.

Table 3.2 A Hausman test – probit model

Correlated Random Effects-Hausman Test Equation: Untitled Test cross-section random effects			
Test summary	Chi-Sq. Statistic	Chi-Sq. d.f	Prob.
Cross-section random	83.92	0.5	0.9985

Source: Author estimated from STATA

Note: Prob. < 0.05 indicate a signification, that is we cannot accept a null hypothesis

From the results in Table 3.1 and 3.2, equation 1 used to examine factors that affect a household's decision making to participate in contract farming as below:

$$P(y=1|X_{ij}) = P(y=1|\ \text{prop\_adult, male, edu\_3, monekhmer, hmonglu, tibetch, debt, prop\_irr, farmsize, poorroad, dt\_province, dt\_mkt, bokeo, luangnamtha}), \quad (1)$$

where y=1 is the probability that households choose to participate in contract farming *(dummycf)* and X_{ij} denote the set of explanatory variables (i are the set of independent variables and j are the number of years). The descriptive, mean, min and max of dependent and independent variables are presented in Table 3.3.

Previous studies used logit and probit models in order to answer the question of what factors that affect household's decision making to participate in contract farming (Miyata et al., 2008; Tionco et al., 2009; Schipmann and Qaim, 2011; Wainain, 2012; Bellemare, 2012; Bellemare and Novak, 2014; Valde and Maertens, 2014). This study differs from previous studies due to the utilization of random effects of logit and probit models to evaluate factors that affect household to participate in contract farming, with each model having a different distribution of error terms so using different models may deliver different results.

Table 3.3 Descriptive statistics

Variables	Definition (unit)	Mean	Min	Max	Expected Signs (references)
Dependent variable					
dummycf	Dummy for participating in contract farming (1= yes and 0= otherwise)	0.3731	0	1	
Independent variables: Farmer characteristics					
prop_adult	A share of adult members (equal to or greater than 18 years old) in household	0.7864	0	1	**Positive** (Miyata et al., 2009; Bellemare, 2012; Bellemare and Novak, 2014; Wainaina et al., 2012)
male	Dummy for male-headed households (1 = male and 0 =otherwise)	0.9382	0	1	**Positive** (Wainaina et al., 2012; Bellemare, 2012; Bellemare and Novak, 2014; Valde and Maertens, 2014)
edu_3	Dummy for head of household educated equal to or greater than 3 years of schooling (1= yes and 0 = otherwise)	0.5475	0	1	**Positive** (Wainaina et al., 2012; Tionco et al., 2009; Bellemare, 2012; Bellemare and Novak, 2014 **Negative** (Patrick, 2004)
laotai	Ethnicity dummy for Lao-Tai group (1= yes and 0 = otherwise)	0.5943	0	1	Base variable

Table 3.3 (Continued)

Independent variables	Definition (unit)	Mean	Min	Max	Expected Signs (reference)
hmonglu	Ethnicity dummy for Hmong-Lumien (1 = yes and 0 = otherwise)	0.1243	0	1	**Negative** (Sodarak, 1999; Andersson et al., 2006; Engvall, 2006; Warr, 2006; Kamiya, 2011; Vixathep et al., 2013)
tibetch	Ethnicity dummy for Tibet-China (1 = yes and 0 = otherwise)	0.1352	0	1	**Positive** (Sodarak, 1999; Andersson et al., 2006; Engvall, 2006; Warr, 2006; Kamiya, 2011; Vixathep et al., 2013)
monekhmer	Ethnicity dummy for Mon-Khmer (1 = yes and 0 = otherwise)	0.1560	0	1	**Negative** (Sodarak, 1999; Kamiya, 2011; Andersson et al., 2006; Engvall, 2006; Warr, 2006; Vixathep et al., 2013)
debt	Dummy for households borrowing money from credit institutions (1 = yes and 0 = otherwise)	0.3180	0	1	**Positive** (Tionco et al., 2009; Rao and Qaim, 2011)

Table 3.3 (Continued)

Independent variables	Definition (unit)	Mean	Min	Max	Expected Signs (reference)
Household Assets					
prop_irr	Share of irrigated land	0.6323	0	1	**Positive** (Patrick, 2004; Miyata et al., 2009) **Negative** (Patrick, 2004)
farmsize	Size of farm (hectares)	1.769	0.010	10	**Positive** (Patrick, 2004; Miyata et al., 2009; Rao and Qaim, 2011)
Location					
poorroad	Dummy for bad road condition during wet and dry seasons (1 = yes and 0 = otherwise)	0.3322	0	1	**Negative** (Warr, 2006; Rao and Qaim, 2011)
dt_province	Distance from village office to provincial office (kilometers)	28.90	0	157	**Negative** (Wainaina et al., 2012)

Table 3.3 (Continued)

Independent variables	Definition (unit)	Mean	Min	Max	Expected Signs (reference)
dt_mkt	Distance from village office to market or nearby market (kilometers)	51.4752	0	157	**Negative** (Wainaina et al., 2012)
bokeo	Dummy for household residing Bokeo province (1 = yes and 0 = otherwise)	0.4106	0	1	**Negative** (Engvall, 2006; Andersson et al., 2006; Krugman et al., 2008; Tionco et al., 2009)
luangnamtha	Dummy for household residing Luangnamtha province (1 = yes and 0 = otherwise)	0.2938	0	1	**Negative** (Engvall, 2006; Andersson et al., 2006; Krugman et al., 2008;Tionco et al., 2009)
phongsaly	Dummy for household residing Phongsaly province (1 = yes and 0 =otherwise)	0.2954	0	1	Base variable

Source: Author's calculation

Table 3.3 shows the definitions and statistical descriptions of the variables used in this study. The statistical descriptions of the dependent variables revealed that the percentage of households that participated in contract farming was approximately 37.31% *(dummycf)*.

Firstly, the statistical description for independent variables that stand for farmer characteristics shows that the proportion of adult members in household on average *(prop_adult)* is 78.64%; 93.82% of the head of the households were male *(male)*; 54.75% of the head of household spent at least three years in school *(educ_3)*. Lao-Tai was the ethnic majority at 59.43% *(laotai)*, followed by Mon-Khmer at 15.6% *(monekhmer)*, Tibet-China at 13.52% *(tibetchn)*, Hmong-Lumen at 12.43% *(hmonglu)*, and 31.80% of households had debt *(debt)*. Lao-Tai is a benchmark case as the ethnic majority was Lao-Tai as stated in Chapter 2. Secondly, the statistical description of household assets revealed that households had shares of irrigated land at approximately 0.6323 hectares *(prop_irr)*. Generally, household owned small-size farms, on average, had 1.769 hectares *(farmsize)*. Thirdly, independent variables that indicate location for household show that households in different locations suffered from poor road conditions during the wet and dry seasons *(poorroad)* on average at 33.22%. The average distance between a village office and a provincial office *(dt_province)* was approximately 28.90 kilometers and the average distance from a village official to a market/nearby market *(dt_mkt)* was 51.47 kilometers. Finally, the geography in northern Laos shows that the Phongsaly province shares a border with China and Vietnam, making farmers had more chance to participate in contract farming as compared to other provinces. As a result, this study utilized Phongsaly as a benchmark case, indicated by a dummy variable for households residing in Phongsaly at 29.54% *(phongsaly)*, and the households in Bokeo *(bokeo)* at 41.06%, and Luangnamtha *(luangnamtha)* at 29.38%.

3.1.2 Impact of contract farming on income

A dependent variable is household income which directly measures farm income per adult equivalent (Bellemare, 2012; Bellemare and Novak, 2014). In order to examine the relationships between independent variables and dependent variables, this study uses the Multiple Linear Regression model and its estimation uses Ordinary Least Squares (OLS), which is the most generally used tool in econometrics (Gujarati, 2004).

Since the data is unbalanced panel data, using only the pooled regression (OLS) was not an effective tool compared to fixed effects and random effects (Gujarati, 2004). In addition, the pooled regression means that we pool the time series and cross-sectional observations and are estimated by fixed effects and random effects regression (Gujarati, 2004). Hence, this study employs a Hausman test to estimate which one is more appropriate model to examine the impact of contract farming on income.

Estimation result is presented in Table 3.4. The estimation shows that we cannot accept a null hypothesis because the probability value equal to 0.0000 that is less than 0.05 (Prob. < 0.05), so the fixed effects model is an appropriate model to examine the impact of contract farming on income.

Table 3.4 A Hausman test – fixed effects or random effects

Correlated Random Effects-Hausman Test Equation: Untitled Test cross-section random effects			
Test summary	Chi-Sq. Statistic	Chi-Sq. d.f	Prob.
Cross-section random	28.81	302.09	0.0000

Source: Author estimated from STATA

Note: Prob. < 0.05 indicate a signification, that is we cannot accept a null hypothesis

Equation 2 is presented the model used to examine the impact of contract farming on income per adult equivalent per year as following:

$$\begin{aligned} \text{finc\_adultequi}_{1-3} = \quad & \beta_0 + \beta_1 \text{ prop\_adult} + \beta_2 \text{ male} + \beta_3 \text{ edu} \\ & + \beta_4 \text{ monekhmer} + \beta_5 \text{ hmonglu} + \beta_6 \text{ tibetch} \\ & + \beta_7 \text{ debt} + \beta_8 \text{ dummybusiness} + \beta_9 \text{ prop\_irr} \\ & + \beta_{10} \text{ farmsize} + \beta_{11} \text{ usefertilizer} \\ & + \beta_{12} \text{ dummycf} + \beta_{13} \text{ dummyelectric} \\ & + \beta_{14} \text{ dummyhealth} + \beta_{15} \text{ poorroad} + \beta_{16} \text{ bokeo} \\ & + \beta_{17} \text{ luangnamtha} + u, \end{aligned} \tag{2}$$

where $finc\_adultequi_{1-3}$ are dependent variables (there are three types of adult equivalence scales: *finc_adultequi1, finc_adultequi2, and finc_adultequi3*), the set of independent variables contained in the right hand side of the equation. The descriptive, mean, min, max of dependent and independent variables explain in Table 3.5. β_0 is the constant term, β_1 to β_{17} are the coefficients of each independent variables, and *u* is the error term which is normal distribution.

Table 3.5 Descriptive statistics

Dependent variables	Definition (unit)	Mean	Min	Max
finc_adultequi1	(Net) farm income per adult equivalent (OECD equivalence scale)	3,760,000	333,333	70,000,000

Table 3.5 (Continued)

Variables	Definition (unit)	Mean	Min	Max	Expected Signs (reference)
Dependent variables					
finc_adultequi2	(Net) farm income per adult equivalent (OECD-modified scale)	4,800,000	428,571	90,000,000	
finc_adultequi3	(Net) farm income per adult equivalent (Square root scale)	6,100,000	536,656	113,000,000	
Independent variables					
Farmer characteristics					
prop_adult	A share of adult members (equal to or greater than 18 years old) in household	0.7864	0	1	**Positive (**Miyata et al., 2009; Bellemare, 2012; Bellemare and Novak, 2014; Wainaina et al., 2012) **Negative** (Andersson et al., 2006; Engvall, 2006)

Table 3.5 (Continued)

Independent variables	Definition (unit)	Mean	Min	Max	Expected Signs (reference)
male	Dummy for male-headed households (1 = male and 0 =otherwise)	0.9382	0	1	**Positive** (Wainaina et al., 2012; Bellemare, 2012; Bellemare and Novak, 2014; Valde and Maertens, 2014)
edu	Education levels of head of households (years)	2.7295	0	14	**Positive** (Wainaina et al., 2012; Bellemare, 2012; Bellemare and Novak, 2014; Valde and Maertens, 2014)
laotai	Ethnicity dummy for Lao-Tai group (1= yes and 0 = otherwise)	0.5943	0	1	Base variable
hmonglu	Ethnicity dummy for Hmong-Lumien (1 = yes and 0 = otherwise)	0.1243	0	1	**Negative** (Sodarak, 1999; Andersson et al., 2006; Engvall, 2006; Warr, 2006; Kamiya, 2011; Vixathep et al., 2013)

Table 3.5 (Continued)

Independent variables	Definition (unit)	Mean	Min	Max	Expected Signs (reference)
tibetch	Ethnicity dummy for Tibet-China (1 = yes and 0 = otherwise)	0.1352	0	1	**Nagative** (Sodarak, 1999; Andersson et al., 2006; Engvall, 2006; Warr, 2006; Kamiya, 2011; Vixathep et al., 2013)
monekhmer	Ethnicity dummy for Mon-Khmer (1 = yes and 0 = otherwise)	0.1560	0	1	**Negative** (Sodarak, 1999; Kamiya, 2011; Andersson et al., 2006; Engvall, 2006; Warr, 2006; Vixathep et al., 2013)
debt	Dummy for households borrowing money from credit institutions (1 = yes and 0 = otherwise)	0.3180	0	1	**Positive** (Tionco et al., 2009; Rao and Qaim, 2011) **Negative** (Patrick, 2004)
dummybusiness	Dummy for farmer households that run business (1 = yes, 0 = otherwise)	0.0492	0	1	**Positive** (Engvall, 2006; Andersson et al., 2006)

Table 3.5 (Continued)

Independent variables	Definition (unit)	Mean	Min	Max	Expected Signs (reference)
Household Assets					
prop_irr	Share of irrigated land	0.6323	0	1	**Positive** (Patrick, 2004; Miyata et al., 2009)
farmsize	Size of farm (hectares)	1.769	0.010	10	**Positive** (Patrick, 2004; Miyata et al., 2009; Rao and Qaim, 2011)
Agricultural Activities					
usefertilizer	Dummy for household use chemical fertilizer in farm (1= yes, 0 = otherwise)	0.5434	0	1	**Positive** (Engvall, 2006; Andersson et al., 2006)
dummycf	Dummy for participating in contract farming (1= yes and 0= otherwise)	0.3731	0	1	**Positive** (Patrick, 2004; Miyata et al., 2009; Rao and Qaim, 2011; Bellemare, 2012; Bellemare and Novak, 2014; Velde and Maertens, 2014) **Negative** (Ken and Rusten, 1999; Warning, 2002; Patrick, 2004)

Table 3.5 (Continued)

Independent variables	Definition (unit)	Mean	Min	Max	Expected Signs (reference)
Access to Electricity and Health Care Services					
dummyelectric	Dummy for household had access to electricity (1 = yes, 0 = otherwise)	0.7946	0	1	**Positive** (Engvall, 2006; Andersson et al., 2006)
dummyhealth	Dummy for household had access to health care service (1 = yes, 0 = otherwise)	0.8814	0	1	**Positive** (Engvall, 2006; Andersson et al., 2006)
Location					
poorroad	Dummy for bad road condition during wet and dry seasons (1 = yes and 0 = otherwise)	0.3322	0	1	**Negative** (Warr, 2006; Rao and Qaim, 2011)
bokeo	Dummy for household residing Bokeo province (1 = yes and 0 = otherwise)	0.4106	0	1	**Negative** (Engvall, 2006; Andersson et al., 2006; Tionco et al., 2009)
luangnamtha	Dummy for household residing Luangnamtha province (1 = yes and 0 = otherwise)	0.2938	0	1	**Negative** (Engvall, 2006; Andersson et al., 2006; Tionco et al., 2009)

Table 3.5 (Continued)

Independent variables	Definition (unit)	Mean	Min	Max	Expected Signs (reference)
phongsaly	Dummy for household residing Phongsaly province (1 = yes and 0 =otherwise)	0.2954	0	1	Base variable

Source: Author's calculation

This study differs from previous studies as follows: this study employs the panel data instead of cross section data. Panel data properly evaluated the long-run relationship between dependent and independent variables than cross section data. Panel data investigate the same observations in year by year while cross section data analyze short-run relationship that is analyzing the individual observations in current year. Therefore, panel data is the good dataset to estimate the impact of contract farming on income than cross section data.

There are many authors use a range of proxies to determine household welfare, e.g., gross agriculture income (Warning and Key, 2002); net income per adult equivalent (Patrick, 2004); expenditure per adult equivalent (Miyata et al., 2009); log of household net income (Bellemare, 2012; Bellemare and Novak, 2014); and net total farm income (Velde and Maertens, 2004).

This study uses farm income per adult equivalent as a proxy to indicate household welfare, based on the data availability. By using the econometrics approach (fixed effects) to evaluate the impact of contract farming on income per adult equivalent.

The studies for adult equivalence scale of Organization of Economics Co-operation Development (OECD) showed that there are three types of contract farming adult equivalence scales:

(1) “OECD equivalence scale” proposed an equivalence scale a value of 1 to the household head, of 0.7 to each additional adult member and of 0.5 to each child *(finc_adultequi1).*

(2) Haagenars et al. (1994) proposed an equivalence scale namely "OECD-modified scale". They assigned a value of 1 to the household head, of 0.5 to each additional adult member and of 0.3 to each child *(finc_adultequi2).*

(3) “Square root scale” used a scale that divides household income by the square root of a household size *(finc_adultequi3).*

In general, there is no accepted method for determining equivalence scales, and there is no equivalence scale recommended by the OECD. The previous studies used different methods to evaluate adult equivalence scales (Bellemare, 2012; Bellemare and Novak, 2014). Therefore, this study employs all types for evaluating the impact of contract farming on household’ income.

The statistical descriptions of this study for three types of adult equivalence scales revealed that on average farm income per adult equivalent “OECD equivalence scale” is 3,760,000 kip per adult equivalent per year *(finc_adultequi1)*, “OECD-modified scale” is 4,800,000 kip per adult equivalent per year *(finc_adultequi2),* and “Square root scale” is 6,100,000 kip per adult equivalent per year *(finc_adultequi3)* (Table 3.5).

The NRI dataset was separated agricultural income into two categories: (1) the net income from their own farm *(finc_adultequ),* and (2) the income from non-farming activities *(non_finc).* Sources of net agricultural income is illustrated in Figure 3.4.

(1) The net income from their own farm was further separated into two subcategories: the net income from crops under contract farming which they did not separate income from which types of crops were produced under contract farming; and the net income from non-contract farming such as rice, banana, rubber and livestock.

(2) Income from non-farming activities included instances the income obtained when farmer work as hired labor on other farms in the same village or a nearby village, and the income obtained from non-timber products.

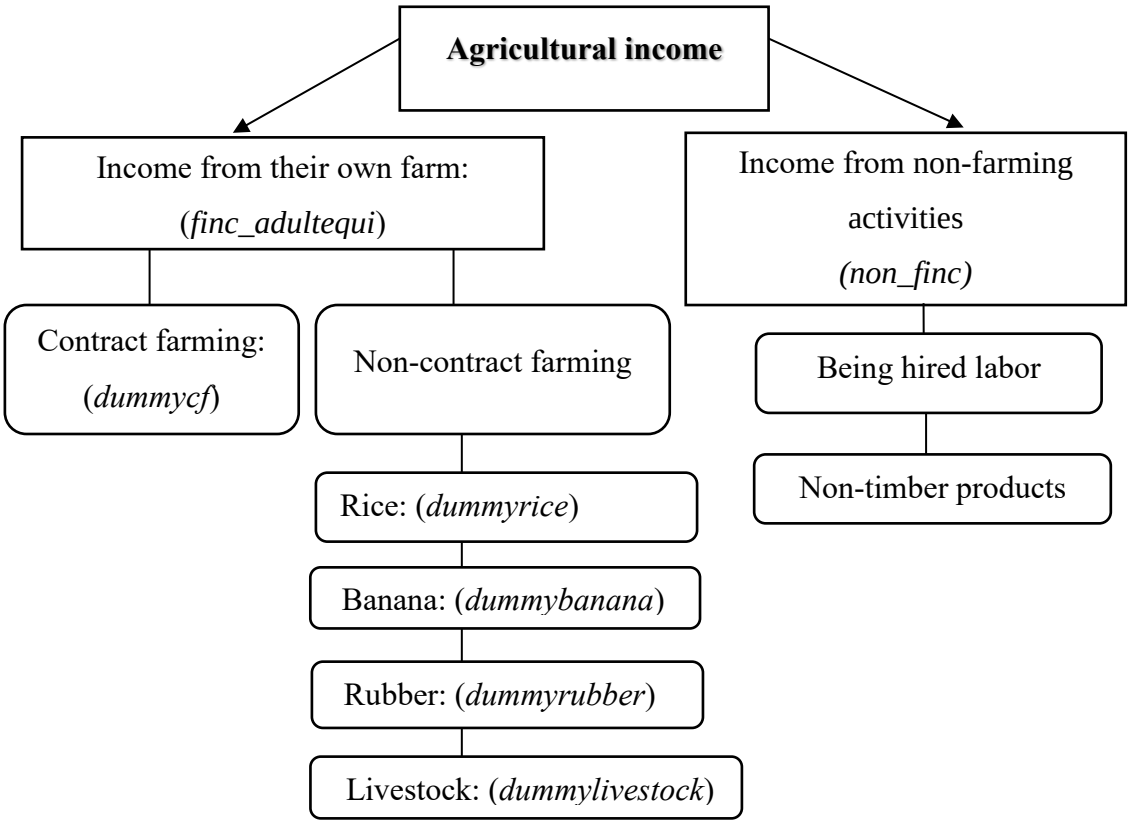

Figure 3.1 Sources of agricultural income

Source: The Northern Rural Infrastructure, 2011.

Households that received income from non-farming activities were households that had no land to produce crops, so they could not participate in contract farming in this study. Therefore, this study solely gathered the data from the households that produced crops on their own farms *(finc_adultequi)* such as the net income from contract farming, and the net income from non-contact farming: rice, banana, rubber and livestock.

Independent variables are organized into five categories: farmer characteristics, household assets, agricultural activities, access to electricity and health care services, and location as presented in Table 3.5. The descriptive data, mean, min, max, and expected signs of some independent variables for three categories (farmer characteristics, household assets, and location) are described in the section 3.1.1. Moreover, independent variables that stand for farmer characteristics show that the average length of schooling of the head households were three years *(edu)*, and

households had own business at 4.92% *(dummybusiness)*, 54.34% of farmers use chemical fertilizer *(usefertilizer)*. Finally, the independent variables that indicate environmental factors are household accesses to electricity at 79.46% *(dummyelectric)*, and household accesses to health care service at 88.14% *(dummyhealth)*.

3.2 Data

This study is based on secondary data collected from the Northern Rural Infrastructure Development Sector Project (NRI), which included 1,198 observations in the northern provinces of Bokeo, Luangnamtha, and Phongsaly, during 2009-2013. The characteristic of NRI data is unbalanced panel data, because there were more irrigation projects every rounds. Hence, NRI randomly selected more households.

Additionally, the NRI project constructed irrigation systems during 2011 to 2013, so the number of households selected by the NRI rose each year (185 households in 2011 increased to 277 households in 2012, and 369 households in 2013). The data in 2009 and 2010 were gathered from the same households in 2011 (the first year of project). After that, during 2011 to 2013, the dataset included the same and new households. This is why the number of households rose as the year increased (NRI, 2013).

The observations are summarized in Table 3.6. Households residing in the three provinces are divided into two groups: contract farming and non-contract farming, from 2009 to 2013. In 2013 there were 153 contract farming households in the sample set (42% of total households), which implies there were more non-contract farming households than households under contract farming.

Table 3.6 Total number of households participating in contract and non-contract farming in three provinces from 2009 to 2013

Year	Contract farming group		Non-contract farming group		Total households
	Number of households	Percentage	Number of households	Percentage	
2009	53	29%	129	71%	182
2010	54	29%	131	71%	185
2011	55	30%	130	70%	185
2012	132	48%	145	52%	277
2013	153	42%	216	58%	369
Total households	153	42%	216	58%	369
Total observations	447	37%	751	63%	1,198

Source: Author calculated based on the NRI project dataset

Table 3.7 presents numbers of Phongsaly households participating in contract farming from 2009 to 2013. The number of households in Phongsaly that participated in contract farming was far higher than the other two provinces (Table 3.8 and Table 3.9). This may be attributed to Phongsaly sharing a border with the key contractors in the northern area of Lao PDR: China and Vietnam.

From 2009 to 2011, the number of Phongsaly households participating in contract farming remained constant and rose sharply in 2012 and 2013 as presented in Table 3.7. In 2013, there were 80 contract households in the sample set (80% of total households). Luangnamtha province had a percentage of households participating in contract farming increased from 27.03% to 27.37% as presented in Table 3.8. In 2013, there were 49 contract households in the sample set (27.37% of total households). Bokeo province had a percentage of households participating in contract farming increased from 14.89% to 26.67% in 2009 to 2013 as presented in Table 3.9. In 2013, there were 24 contract households in the sample set (26.67% of total households).

Table 3.7 Total number of households participating in contract and non-contract farming in Phongsaly province from 2009 to 2013

Year	Contract farming group		Non-contract farming group		Total households
	Number of households	Percentage	Number of households	Percentage	
2009	28	54.90%	23	45.10%	51
2010	28	54.90%	23	45.10%	51
2011	28	54.90%	23	45.10%	51
2012	80	80%	20	20%	100
2013	80	80%	20	20%	100
Total households	80	80%	20	20%	100
Total observations	244	69.12	109	30.88	353

Source: Author calculated based on the NRI project dataset

Table 3.8 Total number of households participating in contract and non-contract farming in Luangnamtha province from 2009 to 2013

Year	Contract farming group		Non-contract farming group		Total households
	Number of households	Percentage	Number of households	Percentage	
2009	10	27.03%	27	72.97%	37
2010	11	29.73%	26	70.27%	37
2011	11	29.73%	26	70.27%	37
2012	28	32.18%	59	67.82%	87
2013	49	27.37%	130	72.63%	179
Total households	49	27.37%	130	72.63%	179
Total observations	109	30.97%	243	69.03%	377

Source: Author calculated based on the NRI project dataset

Table 3.9 Total number of households participating in contract and non-contract farming in Bokeo province from 2009 to 2013

Year	Contract farming group		Non-contract farming group		Total households
	Number of households	Percentage	Number of households	Percentage	
2009	14	14.89%	80	85.11%	94
2010	15	15.46%	82	84.54%	97
2011	15	15.46%	82	84.54%	97
2012	24	26.67%	66	73.33%	90
2013	24	26.67%	66	73.33%	90
Total households	24	26.67%	66	73.33%	90
Total observations	92	19.66	376	80.34	468

Source: Author calculated based on the NRI project dataset

CHAPTER 4

RESULT

4.1 Factors that affect a household' decision making to participate in contract farming

This study employed the random effects of logit (logit RE) and probit models (probit RE) in order to explore the coefficients and partial marginal effects of the factors that affect households' decision making to participate in contract farming. The results are presented in Table 4.1.

There are two models: (1) random effects with cluster standard error by villages of logit model, and (2) random effect s with cluster standard error by villages of probit model. The coefficients of each independent variable are the same for all models but the standard errors as well as the levels of significant are different.

The advantage of the model with robust standard error compared to the model without robust standard error is that when we pool a large sample size their variances are not fix (the presence of heteroscedasticity), that results to an efficient estimation. Thus, we have to adjust the standard error to be efficient by robust standard error (Semykina and Wooldridge, 2013). Appendix B reports the random effects of logit and probit models without robust and cluster standard errors (model 1 and 2), and the random effects of logit and probit models with robust standard errors (model 3 and 4).

Additionally, the advantage of the model with cluster standard error compared to the model with robust standard error is that the households in the same village seem to have the same sources of income and agricultural activities compared to the households from different villages. As a result, models with cluster standard error help us to adjust the standard errors by the groups of the sample (by villages), it can fix both the problem of heteroscedasticity and autocorrelation (Semykina and Wooldridge,

2013). Therefore, the main model in this study is the random effects of logit and probit with cluster standard errors by villages as presented in Table 4.1.

Furthermore, this study utilized the partial marginal effects of independent variables that significantly affected on the probability that a household will decided to participate in contract farming by figure as shown in Appendix B. Since it is easier to see which independent variables had a higher probability of being affected by a dependent variable.

The results of the study as present in Table 4.1 show that the coefficients and partial marginal effects for logit models were similar to those of probit models. Those two models give the same signs of expectation, but the levels of significance are different.

Factors that significantly affect households' decision to participate in contract farming in all models are Tibet-China households *(tibetchn),* a share of irrigated land *(prop_irr),* farm size *(farmsize),* distance between the village office and the provincial office *(dt_province),* households reside in Bokeo *(bokeo)* and Luangnamtha *(luangnamtha).*

The other eight variables, which are a share of adult members in household *(prop_member),* the head of household was male *(male),* the head of household had years of schooling equal to or greater than three *(edu_3),* households are Hmong-Lumien group *(hmonglu)* and Mon-Khmer group *(monekhmer),* household had debt *(debt),* having a poor road condition *(poorroad),* distance between village office and market *(dt_mkt),* do not significantly affect households' decision to participate in contract farming as the previous studies (Miyata et al. 2009; Rao and Qaim, 2011; Bellemare, 2012; Bellemare and Novak, 2014).

Table 4.1 Factors that affect households' decision making to participate in contract farming

Independent variables	(1) logit, RE (cluster villages)		(2) probit, RE (cluster villages)	
	Coef.	Marginal effect	Coef.	Marginal effect
Farmer characteristics				
prop_adult	-1.1054	-0.1453	-0.6517	-0.1547
	(0.7028)		(0.3863)	
male	-0.8851	-0.1164	-0.4814	-0.1143
	(0.5796)		(0.3304)	
edu_3	0.3317	0.0436	0.1716	0.0407
	(0.2807)		(0.1566)	
monekhmer	0.6067	0.0797	0.3451	0.0819
	(0.3895)		(0.2168)	
hmonglu	0.0855	0.0112	0.0253	0.0060
	(0.5026)		(0.2758)	
tibetchn	**1.0277****	**0.1351*****	**0.5632****	**0.1337*****
	(0.3963)		(0.2183)	
debt	-0.2412	-0.0317	-0.1411	-0.0335
	(0.2299)		(0.1304)	
Household assets				
prop_irr	**-0.7427****	**-0.0976****	**-0.4174****	**-0.0991****
	(0.3690)		(0.2054)	
farmsize	**0.1995****	**0.0262****	**0.1105****	**0.0262****
	(0.0881)		(0.0498)	
Location				
poorroad	-0.2743	-0.0360	-0.1565	-0.0371
	(0.2597)		(0.2054)	
dt_province	**-0.0359***	**-0.0047***	**-0.0211***	**-0.0050***
	(0.0207)		(0.0114)	
dt_mkt	-0.0016	-0.0002	-0.0005	-0.0001
	(0.0047)		(0.0025)	
bokeo	**-3.0960*****	**-0.4071*****	**-1.7075*****	**-0.4053****
	(0.7623)		(0.4123)	

Table 4.1 (Continued)

Independent variables	(3) logit, RE (cluster villages)		(4) probit, RE (cluster villages)	
	Coef.	Marginal effect	Coef.	Marginal effect
luangnamtha	**-0.2826*** **	**-0.3763*** **	**-1.5907*** **	**-0.3773** **
	(0.6122)		(0.3290)	
Constant	**3.0477*** **		**1.6907*** **	
	(1.1062)		(0.6086)	
Observations	1,198	1,198	1,198	1,198
Number of households	369	369	369	369

Note: Standard errors are in the parentheses; *** indicates the significance at the 1% level, ** indicates the significance at the 5% level, and * indicates the significance at the 10% level

From the results, the Tibet-China households *(tibetchn)* have significantly more opportunity to participate in contract farming than the Lao-Tai group at 13.51 percent (logit model) and 13.37 percent (probit model), holding other factors constant. This might be because Tibet-China originally migrated from China and 55% of contract farming in northern Laos were invested by Chinese and Vietnamese companies, thus the effect of the same language, attitudes and cultures may influence Tibet-China households to choose to participate in contract farming with Chinese contractors compared to other ethnicities. These results are consistent to the previous studies (Sodarak, 1999; Strickland and Strickland, 1996; Easterly, 2007; Kamiya, 2011).

If the share of a household' irrigated land increased by one percent, there was a lower probability of participating in contract farming by 9.76 percent (logit model) and 9.91 percent (probit model) given other factors being equal. This is because the incremental water is not necessarily input for growing crops under contract farming (farmers who can access irrigation systems might see incremental water suitable for growing crops without contract farming (Patrick, 2004). For instance, Phomvixay (2016), director of NRI, pointed out that the project supplies the irrigation systems for farmers who needed the water for growing rice, particularly in the rainy off-season.

Therefore, the majority of farmers who can access irrigation systems tend to do rice cultivation than growing crops under contract farming (rice is not a crop grown under contract farming).

The partial marginal effects of farm size *(farmsize)* equal to 0.0262 for both logit and probit models and are significant. The results of the estimation show that, holding other factors constant, if the household had a farm size increase by one hectare, the probability of them participating in contract farming will increase by 2.62 percent. This means that a higher area of farm indicated having economies of scale and a higher ability to have higher yields than households who had smaller farm sizes. Furthermore, farmers who had a larger sized farm and participated in contract farming will have more advantages than non-contract farmers, such as access to knowledge, markets, and inputs provision; while non-contract farmers have to find market, inputs, and knowledge themselves. Therefore, contract farmers who have a larger sized farm can reduce the cost per unit of inputs used in their farm (and receive a higher yield) than non-contract farmers (Patrick, 2004; Tionco et al., 2009; Schipmann and Qaim, 2011).

If the distance between the village office and the provincial office *(dt_province)* increased by one kilometer, the probability that a household will decide to participate in contract farming is significantly decreased by 0.47 percent (logit model) and 0.50 percent (probit model), other factors were being equal. This result reveals that the form of contract farming might be the Multipartite model in Chapter 2. It means that provincial officer prefers the nearer villages than those further away as it is difficult for them to access these farmers in terms of transportation and communication, which increases the cost for government to find the contract farmers for the contractors (Miyata et al., 2008; Wainain, 2012; Bellemare, 2012; Bellemare and Novak, 2014; Valde and Maertens, 2014).

Furthermore, the informational interview gathered from the provincial staffs reaffirmed that Multipartite model is one of types of contract farming in Bokeo, Luangnamtha, and Phongsaly provinces, for more detail please see in Section 4.3 (Phommachak, 2016; Sengkhamyong, 2016; and Veingvilai, 2016).

If households reside in Bokeo *(bokeo)* and Luangnamtha *(luangnamtha),* in comparison with a household residing in Phongsaly, they had a lower opportunity to participate in contract farming at 40.71 percent (logit model) and 40.53 percent (probit

models) for households reside in Bokeo *(bokeo)*, and at 37.63 percent (logit model) and 37.73 percent (probit model) for households reside in Luangnamtha *(luangnamtha)* given other factors remaining constant. This result is the same as expected reasons as described in descriptive data (Chapter 3) (Krugman, Obstfeld and Melitz, 2008; Tionco et al., 2009).

4.2 Impact of contract farming on income

The results of the impact of contract farming on farm income per adult equivalent are classified into three scales: *finc_adultequi1* (model 1), *finc_adultequi2* (model 2), *finc_adultequi3* (model 3), using fixed effects with cluster standard error by villages as presented in Table 4.2. The fixed effects models with robust and without robust standard errors are presented in the Appendix C. The R-squared for three models show that all independent variables explain 37.3 percent, 38.1 percent, 41.7 percent (models 1, 2, 3 respectively) of the variation in the farm income per adult equivalent.

Overall, the coefficients and the signs of expectation of each independent variable are the same for all models (except model 3, dummy for household using chemical fertilizer in farm (*usefertilizer*), that had insignificantly negative sign with dependent variable (*finc_adultequi3*). However, the standard errors as well as the levels of significance are different in three models.

Additionally, this study used a Heckman selection model to address the problem of selection bias caused by unobserved factors such as knowledgeable or diligence among contract and non-contract farming groups (Miyata et al., 2008; Bellemare, 2012; Bellemare and Novak, 2014). The results are presented in Table 1 in Appendix D, which suggest that the Inverse Mill Ratio (IMR) had the p-value equal to 0.990 (insignificant), this means that there is no selection bias. Therefore, it is not necessary to use the Heckman selection model to evaluate the impact of contract farming on farm income per adult equivalent.

Table 4.2 Impact of contract farming on income per adult equivalent per year

Independent variables	Fixed effects (cluster villages)		
	(1) (finc_adultequi1)	(2) (finc_adultequi2)	(3) (finc_adultequi3)
Farmer characteristics			
prop_adult	21,680,000	21,470,000	37,120,000
	(1,3610,000)	(15,980,000)	(18,370,000)

Table.4.2 (Continued)

Independent variables	Fixed effects (cluster villages) (1) (finc_adultequi1)	(2) (finc_adultequi2)	(3) (finc_adultequi3)
male	-13,460,000	-15,760,000	-19,270,000
	(5,112,000)	(7,345,000)	(11,430,000)
edu	**2,333,000***	**3,122,000***	**4,817,000***
	(795,384)	(1,019,000)	(1,558,000)
monekhmer	4,571,000	5,362,000	8,914,000
	(3,387,000)	(3,491,000)	(2,574,000)
hmonglu	-12,670,000	-16,120,000	-18,350,000
	(7,410,000)	(9,168,000)	(11,590,000)
tibetchn	-4,700,000	-6,934,000	-9,822,000
	(24,780,000)	(30,460,000)	(35,160,000)
debt	-11,340,000	-14,160,000	-16,920,000
	(5,677,000)	(7,507,000)	(9,956,000)
dummybusiness	1,888,000	3,272,000	4,980,000
	(3,791,000)	(4,475,000)	(5,265,000)
Household assets			
prop_irr	4,121,000	5,068,000	6,476,000
	(2,409,000)	(3,205,000)	(4,075,000)
farmsize	6,987,000	**9,400,000***	**13,690,000***
	(2,522,000)	(3,185,000)	(4,081,000)
Agricultural activities			
usefertilizer	62,707	71,635	-770,254
	(3,694,000)	(4,694,000)	(5,265,000)
dummycf	**16,630,000***	**21,050,000***	**26,180,000***
	(4,994,000)	(6,184,000)	(7,368,000)
Access to Electricity and Health Care Services			
dummyelectric	11,270,000	1,4,630,000	**19,410,000***
	(4,351,000)	(5,234,000)	(5,452,000)
dummyhealth	6,792,000	8,494,000	1,244,000
	(5,797,000)	(7,556,000)	(9,982,000)
Location			
poorroad	-2,391,000	-3,067,000	-3,346,000
	(3,816,000)	(4,583,000)	(4,593,000)
bokeo	**169,400,000***	**216,700,000***	**294,400,000***
	(57,100,000)	(72,920,000)	(95,600,000)
luangnamtha	-13,650,000	-15,070,000	-2,855,000
	(50,450,000)	(64,360,000)	(82,180,000)
Constant	**-69,580,000***	**-87,240,000***	**-140,000,000****
	(20,650,000)	(24,860,000)	(29,470,000)

Table.4.2 (Continued)

Independent variables	Fixed effects (cluster villages)		
	(1) (finc_adultequi1)	(2) (finc_adultequi2)	(3) (finc_adultequi3)
Observations	1,198	1,198	1,198
R-squared	37.3	38.1	41.7
Number of households	369	369	369

Note: Standard errors are in the parentheses; *** indicates the significance at the 1% level, ** indicates the significance at the 5% level, and * indicates the significance at the 10% level

Farm income per adult equivalent were significantly affected by higher years of schooling of the household head *(edu),* larger size of farm *(farmsize),* household participated in contract farming *(dummycf),* household accesses to electricity (*dummyelectric*), and household lives in Bokeo *(bokeo).*

In contrast, a share of adult members in household *(prop_adult),* the household head was male *(male),* households are Mon-Khmer group *(monekhmer),* Hmong-Lumien group *(hmonglu),* and Tibet-China group *(tibetch),* household had debt *(debt),* household had own business *(dummybusiness),* a share of irrigated land *(prop_irr),* households use chemical fertilizer in farm *(usefertilizer),* household access to health care service *(dummyhealth),* household had poor road condition *(poorroad),* households reside in Luangnamtha *(luangnamtha),* did not significantly affect farm income per adult equivalent.

The results of significant variables that presented in Table 4.2 are revealed as following:

The coefficient for years of schooling of the household head *(edu)* equals 2,333,000 (model 1), 3,122,000 (model 2), 4,817,000 (model 3) and are significant. This result suggests that if year of schooling of the household head increased by one year, farm income per adult equivalent of the household, on average, increased by 2,333,000 kip per year, 3,122,000 kip per year, 4,817,000 kip per year (models 1,2, 3 respectively), holding other factors constant. The reasons are that higher levels of

education indicated a considerable investment, having more skills of labor, and ability to adapt the knowledge into farm activities, which resulted in increased crop yields in comparison to the head of household who has low levels of education (Miyata et al., 2008; Wainaina et al., 2012; Bellemare, 2012; Bellemare and Novak, 2014; Valde and Maertens, 2014).

If the area of farm increased by one hectare, farm income per adult equivalent of household, on average, increased by 9,400,000 kip per year (model 2) and 13,690,000 kip per year (model 3), and are significant, when keep other factors are constant. This means that, a larger size of farm indicated higher crop yields and economies of scale, which contributed to a higher farm income as compared to household had a smaller size of farm (Patrick, 2004; Rao and Qaim, 2011; Bellemare, 2012; Bellemare and Novak, 2014).

The coefficient for household participated in contract farming *(dummycf)* equals 16,630,000 (model 1), 21,050,000 (model 2), 26,180,000 (model 3) and are significant. This means that, holding other factors constant, if household participated in contract farming, on average, were increased farm income per adult equivalent by 16,630,000 kip per year (model 1), 21,050,000 kip per year (model 2), 26,180,000 kip per year (model 3) as compared to household did not participate in contract farming. The sign for household participated in contract farming are as expected and the same as previous studies (Warning, 2002; Patrick, 2004; Miyata et al., 2009; Rao and Qaim, 2011; Bellemare, 2012; Bellemare and Novak, 2014; Velde and Maertens, 2014).

This might be because the contractor guaranteeing the price of products as well as facilitating inputs, credit, market information and know-how for the farmers (Hamilton, 2008). Thus, contract farming can help farmers reduce the risks of farming in the case of fluctuating market prices, development market information as well as improvement of productivity by receiving technological transfer from foreign contractor, which contributes to increase in income (Warning, 2002; Patrick, 2004; Miyata et al., 2009; Rao and Qaim, 2011; Bellemare, 2012; Bellemare and Novak, 2014; Velde and Maertens, 2014).

Households that have access to electricity compared to households that could not access electricity, have on average, increased farm income per adult equivalent by 19,410,000 kip per year (model 3), and this is significant. This means that, households that can access infrastructure in a village, electricity in this case, might have the benefit

of electricity to generate income so that farmers can purchase televisions or audio equipment (improving farmer' access to advice or information on agricultural farming), and technology and equipment used in the farm. It indirectly contributed to higher farming productivity compared to households that cannot access electricity (Andersson et al., 2006; Engvall, 2006).

Furthermore, households that have access to electricity might directly improve the standard of living of farmers, particular farmers who live in remote area of Laos, since electric lights help improve indoor air quality and safety, which opens up educational opportunities for farmers. Thus, households that have access to electricity improved farm income more than that cannot access electricity (Warr, 2006).

The households residing in Bokeo provinces have coefficients equal to 169,400,000 (model 1), 216,700,000 (model 2), 294,000,000 (model 3), and are significant. This means that households live in Bokeo as compared to households live in Phongsaly had a higher farm income per adult equivalent on average by 169,400,000 kip per year, 216,700,000 kip per year, 294,000,000 kip per year (model 1, 2, 3 respectively).

This might be because Bokeo had a crop yield per hectare (equal to 536.23 ton per hectare in 2013) higher than Phongsaly (equal to 480.12 ton per hectare in 2013). Higher crop yields in Bokeo province contribute to higher farm income for households live in Bokeo province as compared to Phongsaly province (LSB, 2013). This might be because Bokeo province has a higher quality of land and suitable of rainfall as compared to Phongsaly province, which contributed to higher crop yields and farm income for the farmers reside in Bokeo province (Haberecht, 2009).

4.3 Factors that affect households' farm production

Other than the results were estimated by the econometric methods above, there are vital data and related to this research problem as following:

The data obtained from the NRI by quantitative data during 2009 to 2013 revealed that factors that affect households' farm production and income among contract and non-contract farming groups are presented as following:

Contract farmers representative: although contract farming improved farmers' income, factors that affecting farmers' farm production under contract farming are insufficient water (rainfall limitation or lack of water during dry season) at 50.44%, poor communication with extension agents at 40.44%, insufficient technical know-how

at 38.67%, inadequate land at 35.63%, poor transportation/roads at 28.22%, low price of farm products at 24.44%, poor soils and topography at 16.67%, lack of working capital to buy new inputs at 11.78%, diseases at 10.67%, and high cost of inputs at 5.78% (NRI, 2013). For more detail, please see in the Figure 1 on Appendix F.

Non-contract farmers representative: factors that affecting farmers' farm production for non-contract farmers are insufficient technical know-how at 61.30%, rainfall limitation or lack of water during dry season at 42.83%, high cost of inputs at 38.63%, low price of farm production at 38.63%, inadequate land at 36.63%, inadequate extension (poor communication with extension agents) at 36.14%, poor transportation/roads at 35.63%, poor soils and topography at 27.28%, lack of working capital to buy new inputs 23.59%, and diseases at 23.15% (NRI, 2013). For more detail, please see in the Figure F.1 on Appendix F.

4.4 Information gathering interviews with the government officers

Along with the data estimated in the models and the results from quantitative data above, this study also provides an informational interview with government officers in three provinces that link to research problems from this study:

4.4.1 Information gathering interview with a government officer in Phongsaly province

Phommachak (2016) pointed out that there have been three types of contract farming models in Phongsaly since 2002, which are Informal, Intermediate, and Multipartite models. Informal model, contractor and farmer create a verbal or written contract between themselves without any monitoring from the Lao government; Intermediate model, contractors (mostly Chinese and Vietnamese investors) and/or middlemen (either Laotian or foreigner) offer a written or formal contract to farmers. In addition to this, a government staff member (a provincial officer) examines the proposed contract. After that, the provincial officers will assign district officers and a village leader to monitor the contract farming company every 2 or 3 months; and Multipartite model, contractors (mostly Chinese and Vietnamese) and the Lao government with foreign aid will inform a provincial office to find a contract farmer for them. From here, the contractor and farmers will make a written or formal contract. In addition, provincial officers will distribute contract farming information to the district office, then the district office will pass on the information to a village leader in order to

find contract farmers. In some cases, provincial officers/NGO/UN (the third party) will go directly to the village to find contract farmers. The third party will also monitor and manage the production process.

Moreover, Intermediate and Multipartite models had more advantages than an Informal model because, under Intermediate and Multipartite models, they made a written contract that is monitored by government staff. Contractors and farmers strictly abide by the rules specified in the contract. This results in benefits for both contractors and farmers. Informal model had more disadvantages than Intermediate and Multipartite models because contractors and farmers did not follow the rules described in the contract because government staffs are not monitoring it (example: Contractors delayed payment and farmers sold crops to other buyers). Contractors in this model choose not to deal with government staff because they do not want to pay the tax enforced by the Lao government.

From the three models applied in Phongsaly, on average, there are 60% of Intermediate and Multipartite models and 40% of an Informal model, and crops produced under contract farming are corn, bananas, soybeans, and bitter cucumbers. They are exported specifically to China and Vietnam.

Furthermore, the obstructs affected farm production for contract farmers group showed that there is problem such as poor infrastructure, particularly farmers located in mountainous areas or far distances from the village office because they cannot deliver the products on time and they lose perishable crops on the way to a contractor's base. Consequently, they lose revenue.

Additionally, Phommachak (2016) mentioned that non-contract farmers group had many buyers want to buy agricultural products but most farmers in rural areas experience poor road conditions during wet and dry seasons or do not have road at all. The effect of poor roads are the main challenge is the difficulty to sell crops, and buy pesticides and/or insecticides, particularly for farmers located in mountainous areas or areas located far from a district center. Although, they originally gained their farming knowledge from their ancestors, but it is obsolete now so their productivity is low. They do not have enough expertise, access to train in producing crops for commercial products and have less information about market demand.

4.3.2 Information gathering interview with a government officer in Bokeo province

Sengkhamyong (2016) specified that Bokeo have the same types of contract farming as Phongsaly. However, an Intermediate model in Bokeo has only Lao traders as intermediaries who rely solely on a Chinese financier. The intermediary is paid for his services on a commission base from the Chinese financier. In addition, the local

government representative plays the role of a facilitator and coordinator monitoring the contract farming project around 1-2 times per month.

Under Intermediate and Multipartite models, the payment must be received within ten days after a harvest period. The quality of the product is based on its weight. While under an Informal model, contractors set unclear guidelines on the required quality of harvested products, so the quantity and quality of products do not meet their standards. It was difficult to ensure the commitment between farmers and contractors because there were many problems such as delays in payment. In general, the payment was received within a few weeks after a harvest period but, sometimes, the payment was delayed by a few months when prices fluctuated in China or natural disasters occurred. This resulted in lost revenue. Additionally, contractor representatives pointed out that farmers did not follow the cultivation instructions resulting in poor yield, so the quantity did not meet the standard, and sometimes, farmers sold the products to other buyers.

Moreover, there were approximately 50% of Intermediate and Multipartite models, and 50% of an Informal model. In addition, there were about 36 investment projects in 2016. Foreigners (China, Thailand, and Vietnam) invested in 29 of those projects and the rest were by domestic investors. 28 projects were concentrated in the Houayxay district, its border Luangnamtha to the northeast, while there are 8 projects in the Tonphueng district.

Crops produced and demanded from market under contract farming revealed that 70% of all investments were in rubber plantations. The rest were in sugarcane, bananas, cassava, watermelons, and pumpkins. Of these crops, sugarcane has the highest export value at approximately 45% of the total export value, which was exported to Thailand, and the rest being exported to China and Vietnam.

Additionally, the obstructs affected farm production for contract farmers group is farmers do not have enough roads. It is difficult for contractors to collect the crops quickly and deliver crops to the market on time, especially highly perishable crops. Although the contactor provides the seeds, fertilizers and other inputs, the initial cost of land clearance and preparation is a heavy burden that some households find difficult to bear. There is only a very limited amount of land available. Borrowing land seems impractical because the leasing cost is very high and it would not be profitable.

Lastly, major obstacles that affect farm production for non-contract farmers are lack of money to buy inputs, clear out land, and buy equipment, and their limited access to information about contract farming

.

4.3.3 Information gathering interview with a government officer in Luangnamtha province

Veingvilai (2016) mentioned that there are three models: Informal, Multipartite and Intermediate models (the divinations are the same as in Bokeo provinces). Most contract farming projects are located in the Nam Bak village, Long district, because the village shares a small border with China.

Intermediate and Multipartite models have more advantages than an Informal model. Intermediate and Multipartite models, farmers significantly benefit from contract farming in two ways: (1) they have confidence after they grow in-demand crops, and (2) they can expand their crops to international markets and increase their income; under an Informal model, farmers used pesticides without protective equipment. They never used chemical fertilizers or pesticides before so they do not know how they affect rice or fish. Contractors failed to supply the fertilizer on time, (sometimes, it would be 2 weeks late) so farmers would have to use manure instead and the plants would, in turn, die because the fertilizer was late. Farmers want to learn more about making contracts (because farmers have little education), and correct safety measures.

Additionally, there are approximately 70% of Informal model, and 30% of Intermediate and Multipartite models. Crops produced under contract farming are chilies, which are exported to China, and corn, peanuts, and soya beans, which are exported to Thailand and Vietnam.

The obstructs affected farm production for contract farmers group are, under Intermediate and Multipartite models, farmers typically work with the contractor's technical advisor. However, many problems arise because the technical advisor lacks expertise on local conditions. They need expert technical staff, and easier access to training on how to grow crops efficiently.

Furthermore, non-contract farmers need irrigation systems to grow crops during the dry seasons because they depend mainly on the weather. Moreover, due to a lack of money, the initial cost required to clear and prepare the land for farming were problematic.

CHAPTER 5

CONCLUSION

5.1 Conclusion

This study examines the impact of contract farming on income of 1,198 observations in three provinces in northern Laos: Bokeo, Luangnamtha and Phongsaly from 2009 to 2013. The purposes of this study were to: (1) explore the relevant factors that affect farmers' decision-making with regard to entering into contract farming; and (2) analyze the impact of contract farming on income per adult equivalent.

The results of this study show that the factors that affect households' decision to participate in contract farming were households in the Tibet-China group, having a smaller share of irrigated land, having a larger farm size, and having a shorter distance between the provincial office and the village office. Moreover, Bokeo households had fewer opportunities to participate in contract farming than Luangnamtha households did.

Farm income per adult equivalent were positively affected by higher years of schooling of the head of household, having a larger farm size, households that participated in contract farming, and households access to electricity. Moreover, on average, Bokeo households had higher income compared to income of Phongsaly households.

5.2 Limitation of the study and recommendation

This study had a limitation of data due to the limited availability of data from the NRI as follows:

Firstly, this study does not include the data on when farmers began participating in contract farming nor how much more or less contract farmers received in income as compared to before participating in contract farming. Secondly, this study does not include data on which types of contract farming each household entered to produce (i.e., four types of contract farming that applied in Laos, as stated in Chapter 2), and exactly which types of crops were produced under contract farming. Thirdly, this study does not include data on assets' value belonging to households such as amount of new media (e.g., cell phones, televisions, radio). Since the previous studies showed that they are also factors that influence household' decision to participate in contract farming (Patrick, 2004; Tionco et al., 2009; Schipmann and Qaim, 2011). Thus, further studies should consider seriously these factors. Lastly, this study does not include data on the quality of land and the quantity of rainfall that might affect farm income, future studies should take into account these factors.

5.3 Policy implication

The result of the study shows that there are several ways for the Lao government to alleviate the problems of poverty for the farmers.

Firstly, the result of the study shows that poor farmers who were the head of their households had low levels of education, smaller sized farms, did not have access to electricity, and lived in the Bokeo province. Thus, the government should prioritize their budget for households with these characteristics. Furthermore, the government should provide infrastructure and electricity because having access to electricity significantly helps farmers improve their income.

Secondly, other than the policy implication above, to support households participate in contract farming the government should targeting the following groups: households in the Tibet-China group, households that have a smaller share of irrigated land and a larger size of farm, households located far from the provincial office, and households in the Phongsaly province. This is because those characteristics of farmer had a higher probability to participate in contract farming than other characteristics of farmer. Specifically, the provincial officers should distribute information about contract farming to these groups to increase the rate of participation in contract farming.

Moreover, the results from interviews with provincial staff have showed that in Phongsaly, farmers have poor transportation and roads are not sufficient in remote areas, which it is the main obstacle for rural farmers to access the market for both commercial and inputs markets. Thus, providing better roads will improve the standard of living of rural farmers in this province (Phommachak, 2016).

In Luangnamtha, local staff and farmers face severe difficulties in terms of human resources, especially in terms of knowledge about business and markets. Therefore, the government should provide more training on business and markets for local staff (particularly, the leader of village who directly gives technical advice to farmers). Local staff can be a very important resource in supporting farmers in terms of providing technical training and extension services, farmer learning and market integration (Veingvilai, 2016).

Finally, in Bokeo, access to irrigation systems and capital for farming investments is the challenge that prevents the ability of farmers to add value. Farmers mostly depend on the climate and the seasons of crops, and lack the money needed to expand their investment due to lack of access to credit. Thus, the government should support farmers by providing irrigation systems and access to credit, which can help farmers in Bokeo overcome those constraints, resulting in improved productivity in farms and return a higher standard of living of farmers (Sengkhamyong, 2016).

These are reasonable strategies for alleviating problems of poverty, and improving the standard of living for households in Bokeo, Luangnmatha and Phongsaly in northern Laos.

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APPENDICES

Appendix A

The main agricultural crops in Phongsaly, Bokeo and Luangnamtha provinces

1. The main agricultural crops in Phongsaly provinces

In Phongsaly province, the main agriculture production are sugarcane, follow by rice, vegetables, and beans during year 2007 to 2014. In 2014, the value of Sugarcane was 35%, follow by the value of rice 16% and 15% of value of vegetables and beans over the value of all agriculture production (LSB, 2014).

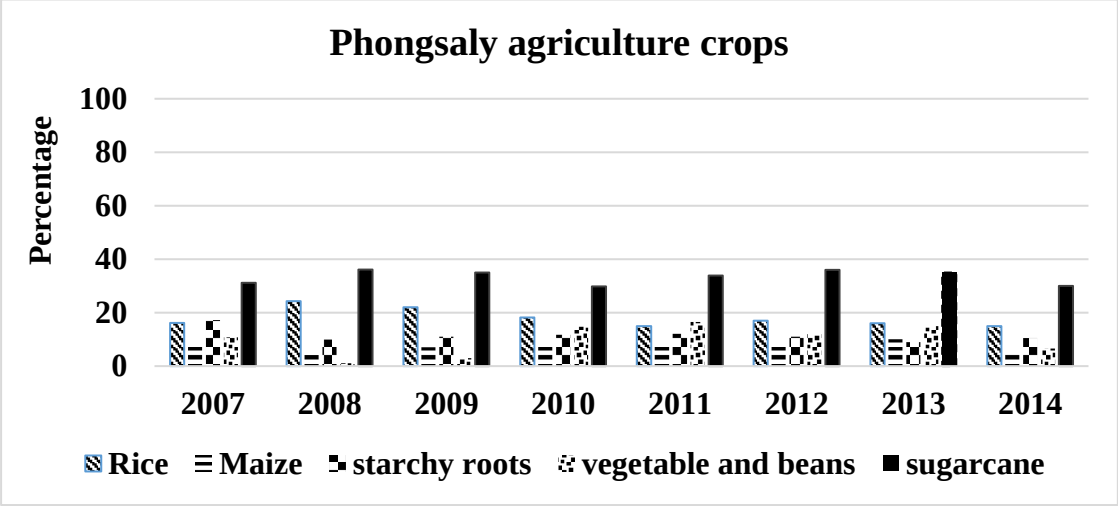

Figure A.1 Top five agricultural crops in Phongsaly during 2007 to 2014

Source: Lao Statistics Bureau, 2014.

2. The main agricultural crops in Luangnamtha province

In Luangnamtha province, during years 2007 to 2014 sugarcane was the main agricultural product, rice was the second largest share of all value of agriculture production followed by starchy roots. In 2014, the value of sugarcane was 55% of

overall value of agriculture production followed by rice 16% and starchy roots 12% (LSB, 2014).

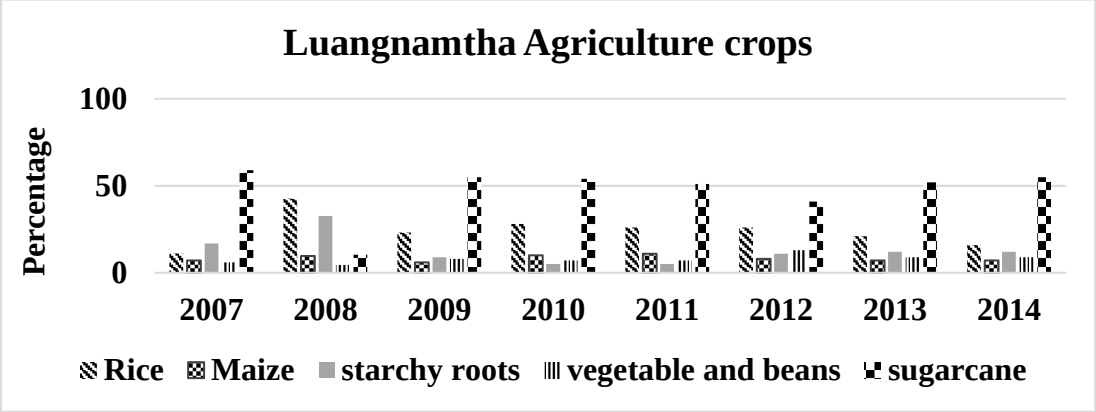

Figure A.2 Top five agricultural crops in Luangnamtha during 2007 to 2014
Source: Lao Statistics Bureau, 2014.

3. The main agricultural crops in Bokeo province

In Bokeo province, maize was the main agricultural product, followed by rice and vegetables and beans during years 2007-2014. In 2014, the value of rice was 36.42% of the whole agricultural production followed by maize 26.64% and vegetable and beans 23.03% (LSB, 2014).

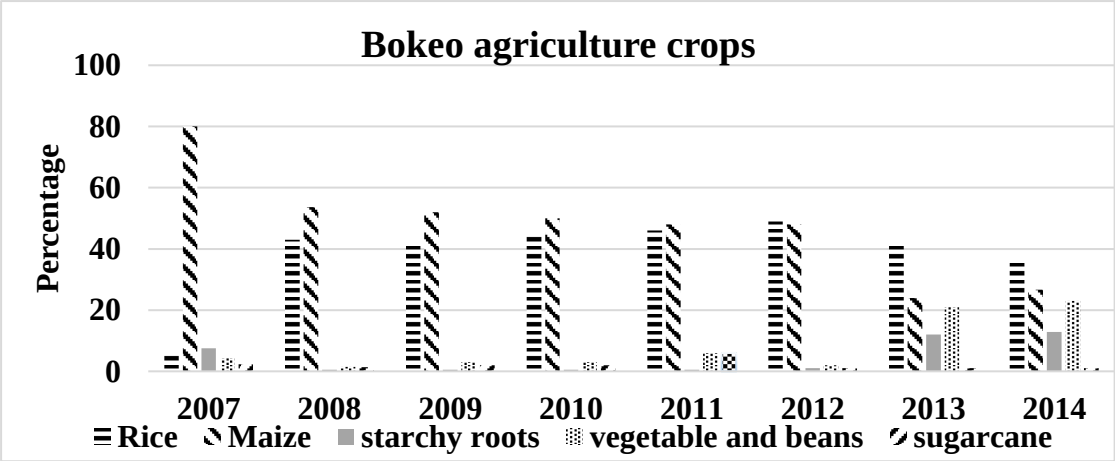

Figure A.3 Top five agricultural crops in Bokeo during 2007 to 2014
Source: Lao Statistics Bureau, 2014.

Appendix B

Factors that affect a household to participate in contract farming by random effects of logit and probit models without robust and cluster standard errors

Table B.1 presents the coefficients and the partial marginal effects of factors that affect household's decision to participate in contract farming by using random effects of logit model (model 1) and probit model (model 2) without robust and cluster standard errors.

Table B.1 Factors that affect household' decision to participate in contract farming

Independent variables	(1) logit, RE		(2) probit, RE		(1) logit, RE (robust)		(2) probit, RE (robust)	
	Coef.	Marginal effect	Coef.	Marginal effect	Coef.	Marginal effect	Coef.	Marginal effect
Farmer characteristics								
prop_adult	-1.1054	-0.1453	-0.6517	-0.1547	-1.1054	-0.1453	-0.6517	**-0.1547***
	(0.7271)		(0.4010)		(0.7271)		(0.4010)	
male	**-0.8851****	**-0.1164****	**-0.4814***	**-0.1143***	-0.8851	-0.1164	**-0.4814***	**-0.1143***

Independent variables	(1) logit, RE		(2) probit, RE		(1) logit, RE (robust)		(2) probit, RE (robust)	
	Coef.	Marginal effect	Coef.	Marginal effect	Coef.	Marginal effect	Coef.	Marginal effect
	(0.6320)		(0.2708)		(0.6320)		(0.2708)	
edu_3	**0.3317****	**0.0436****	**0.1716****	0.0407	0.3317	0.0436	0.1716	0.0407
	(0.2297)		(0.1283)		(0.2297)		(0.1283)	
monekhmer	**0.6067****	**0.0797****	**0.3451***	**0.0819***	**0.6067***	**0.0797***	0.3451	0.0819
	(0.3451)		(0.2496)		(0.3451)		(0.2496)	
hmonglu	0.0855	0.0112	0.0253	0.0060	0.0855	0.0112	0.0253	0.0060
	(0.4960)		(0.2564)		(0.4960)		(0.2564)	
tibetchn	**1.0277*****	**0.1351*****	**0.5632*****	**0.1337*****	**1.0277*****	**0.1351*****	**0.5632*****	**0.1337*****
	(0.3659)		(0.1870)		(0.3659)		(0.1870)	
debt	-0.2412	-0.0317	-0.1411	-0.0335	-0.2412	-0.0317	-0.1411	-0.0335
	(0.2524)		(0.1229)		(0.2524)		(0.1229)	
Household assets								
prop_irr	**-0.7427*****	**-0.0976*****	**-0.4174*****	**-0.0991*****	**-0.7427*****	**-0.0976*****	**-0.4174****	**-0.0991****
	(0.2818)		(0.1902)		(0.2818)		(0.1902)	
farmsize	**0.1995*****	**0.0262*****	**0.1105*****	**0.0262*****	**0.1995****	**0.0262****	**0.1105****	**0.0262****
	(0.0822)		(0.0535)		(0.0822)		(0.0535)	
Location								
poorroad	-0.2743	-0.0360	-0.1565	-0.0371	-0.2743	-0.0360	-0.1565	-0.0371
	(0.2726)		(0.1472)		(0.2726)		(0.1472)	
dt_province	**-0.0359****	**-0.0047****	**-0.0211****	**-0.0050****	**-0.0359***	**-0.0047***	**-0.0211***	**-0.0050***
	(0.0211)		(0.0111)		(0.0211)		(0.0111)	
dt_mkt	-0.0016	-0.0002	-0.0005	-0.0001	-0.0016	-0.0002	-0.0005	-0.0001
	(0.0048)		(0.0025)		(0.0048)		(0.0025)	
bokeo	**-3.0960*****	**-0.4071*****	**-1.7075*****	**-0.4053*****	**-3.0960*****	**-0.4071*****	**-1.7075*****	**-0.4053*****

Independent variables	(1) logit, RE		(2) probit, RE		(1) logit, RE (robust)		(2) probit, RE (robust)	
	Coef.	Marginal effect	Coef.	Marginal effect	Coef.	Marginal effect	Coef.	Marginal effect
	(0.7834)		(0.4245)		(0.7834)		(0.4245)	
luangnamtha	**-0.2826*** **	**-0.3763*** **	**-1.5907*** **	**-0.3773*** **	**-0.2826*** **	**-0.3763*** **	**-1.5907*** **	**-0.3773*** **
	(0.6283)		(0.3522)		(0.6283)		(0.3522)	
Constant	**3.0477*** **		**1.6907** **		**3.0477*** **		**1.6907**	
	(1.1673)		(0.5389)		(1.1673)		(0.5389)	
Observations	1,198	1,198	1,198	1,198	1,198	1,198	1,198	1,198
Number of households	369	369	369	369	369	369	369	369

Note: Standard errors are in the parentheses; *** indicates the significance at the 1% level, ** indicates the significance at the 5% level, and * indicates the significance at the 10% level

Appendix C

Impact of contract farming on income by fixed effects without robust and cluster standard errors

Table C.1 shows the coefficients of factors that affect farm income per adult equivalent (Three scale of adult equivalent) by fixed effects (without robust and cluster standard errors) and fixed effects (with robust standard error).

Table C.1 Impact of contract farming on income by fixed effects without robust and cluster standard errors

Independent variables	Fixed effects			Fixed effects (robust)		
	(1)	(2)	(3)	(4)	(5)	(6)
	finc_adultequi1	finc_adultequi2	finc_adultequi3	finc_adultequi1	finc_adultequi2	finc_adultequi3
Farmer characteristics						
prop_adult	**21,680,000*** **	**21,470,000** **	**37,120,000*** **	**21,680,000** **	**21,470,000***	**37,120,000*** **
	(7,587,000)	(9,567,000)	(1,196,000)	(9,137,000)	(11,650,000)	(14,120,000)
male	**-13,460,000** **	**-15,760,000***	-19,270,000	-13,460,000	-15,760,000	-19,270,000
	(6,676,000)	(8,418,000)	(10,520,000)	(9,178,000)	(11,630,000)	(14,360,000)
edu	**2,333,000*** **	**3,122,000*** **	**4,817,000*** **	**2,333,000** **	**3,122,000** **	**4,817,000*** **
	(791,101)	(997,581)	(1,247,000)	(1,089,000)	(1,390,000)	(1,761,000)
monekhmer	4,571,000	5,362,000	8,914,000	4,571,000	5,362,000	8,914,000
	(5,015,000)	(6,323,000)	(7,902,000)	(6,668,000)	(8,460,000)	(11,040,000)
hmonglu	**-12,670,000** **	**-16,120,000*** **	**-18,350,000** **	**-12,670,000** **	**-16,120,000** **	**-18,350,000** **
	(4,936,000)	(6,224,000)	(7,777,000)	(4,958,000)	(6,323,000)	(8,145,000)
tibetchn	-4,700,000	-6,934,000	-9,822,000	-4,700,000	-6,934,000	-9,822,000
	(4,147,000)	(5,229,000)	(6,535,000)	(6,073,000)	(7,561,000)	(8,947,000)
debt	**-11,340,000*** **	**-14,160,000*** **	**-16,920,000*** **	**-11,340,000*** **	**-14,160,000*** **	**-16,920,000*** **
	(3,058,000)	(3,857,000)	(4,819,000)	(3,634,000)	(4,631,000)	(5,866,000)
dummybusiness	1,888,000	3,272,000	4,980,000	1,888,000	3,272,000	4,980,000
	(3,826,000)	(4,824,000)	(6,028,000)	(6,463,000)	(8,086,000)	(10,070,000)
Household assets						
prop_irr	4,121,000	5,068,000	6,476,000	4,121,000	5,068,000	6,476,000
	(3,997,000)	(5,040,000)	(6,298,000)	(4,473,000)	(5,619,000)	(6,883,000)
farmsize	**6,987,000*** **	**9,400,000*** **	**13,690,000*** **	**6,987,000*** **	**9,400,000*** **	**13,690,000*** **
	(935,392)	(1,180,000)	(1,474,000)	(1,275,000)	(1,631,000)	(2,108,000)

Table C.1 (Continued)

Independent variables	Fix effects			Fix effects (robust)		
	(1)	(2)	(3)	(4)	(5)	(6)
	finc_adultequi1	finc_adultequi2	finc_adultequi3	finc_adultequi1	finc_adultequi2	finc_adultequi3
Agricultural activities						
usefertilizer	62,707	71,635	-770,254	62,707	71,635	-770,254
	(3,356,000)	(4,232,000)	(5,288,000)	(2,908,000)	(3,602,000)	(4,244,000)
dummycf	**16,630,000*** **	**21,050,000*** **	**26,180,000*** **	**16,630,000*** **	**21,050,000*** **	**26,180,000*** **
	(3,472,000)	(4,378,000)	(5,470,000)	(4,644,000)	(5,840,000)	(7,316,000)
Access to Electricity and Health Care Services						
dummyelectric	**11,270,000*** **	**14,630,000*** **	**19,410,000*** **	**11,270,000*** **	**14,630,000*** **	**19,410,000*** **
	(3,922,000)	(4,945,000)	(6,179,000)	(3,980,000)	(4,997,000)	(6,189,000)
dummyhealth	6,792,000	8,494,000	**1,2440,000***	6,792,000	8,494,000	12,440,000
	(4,517,000)	(5,696,000)	(7,118,000)	(6,276,000)	(7,971,000)	(1,011,000)
Location						
poorroad	-2,391,000	-3,067,000	-3,346,000	-2,391,000	-3,067,000	-3,346,000
	(3,036,000)	(3,828,000)	(4,784,000)	(3,807,000)	(4,832,000)	(5,984,000)
bokeo	**169,400,000*** **	**216,700,000*** **	**294,400,000*** **	**169,400,000*** **	**216,700,000*** **	**294,400,000*** **
	(18,450,000)	(23,270,000)	(29,080,000)	(23,940,000)	(30,800,000)	(44,280,000)
luangnamtha	-13,650,000	-15,070,000	-2,855,000	-13,650,000	-15,070,000	-2,855,000
	(18,860,000)	(23,780,000)	(29,710,000)	(26,300,000)	(33,460,000)	(45,570,000)
Constant	**-69,580,000*** **	**-87,240,000*** **	**-140,000,000*** **	**-69,580,000*** **	**-87,240,000*** **	**-140,000,000*** **
	(17,830,000)	(22,480,000)	(28,090,000)	(17,660,000)	(22,500,000)	(31,900,000)
Observations	1,198	1,198	1,198	1,198	1,198	1,198
R-squared	37.3	38.1	41.7	37.3	38.1	41.7
Number of households	369	369	369	369	369	369

Note: Standard errors are in the parentheses; *** indicates the significance at the 1% level, ** indicates the significance at the 5% level, and * indicates the significance at the 10% level

Appendix D

A Heckman selection correction model or treatment effects model of the impact of contract farming on income

This study addresses the question of whether households participated in contract farming and whether there is a selection bias caused by unobserved factors such as knowledgeable or diligence for household among contract and non-contract farming groups. Hence, if there is selection bias it would give a false conclusion of the impact of contract farming on income and result in ill-informed policy implications to support farmers to participate in contract farming.

Miyata et al. (2008) and Bellemare (2012) introduced the impact of participating on contract farming estimated income by using Heckman selection model or treatment effects model instead of OLS regression to solve this question. Heckman selection model involves in two equations: (1) the selection equation: the probability of farmers to participate in contract farming; and (2) outcome regression: the impact of contract farming on farm income (Table D.1).

The selection equation estimates the probability of farmers to join contract farming in order to calculate the Inverse Mill Ratio (IMR). After having the IMR in selection equation, use this as an independent variable to put in the outcome regression. The p-value of IMR is insignificant, meaning that there is no selection bias. Therefore, using Heckman selection model is not necessary to evaluate the impact of contract farming on farm income, in other words, in panel data by using fixed effects with cluster standard error already accounts for the selection bias problem.

Table D.1 A Heckman selection correction model of the impact of contract farming on farm income per capita

Variables	Coefficient	Standard Error	P[|Z|>z]
Outcome equation			
Dependent variable: farm income per adult equivalent per year			
dummycf	7,317,500	113,834.6	6.43***
prop_adult	2,932,720	59,180.52	-4.96***
male	-3,327,250	495,410	-0.67
edu	4,678,000	14,721.88	3.17***
monekhmer	6,183,850	381,589.5	1.62
hmonglu	-2,329,160	424,766.5	-0.55
tibetchn	1,199,869	337,316.6	3.56***
farmsize	4,745,360	77,012.81	6.16***
debt	-5,693,700	258,092.5	-2.21**
dummybusiness	5,403,550	245,302.6	2.20**
usefertilizer	-2,572,510	101,595.3	-2.53**
dummyelectric	4,634,610	168,809	2.75***
dummyhealth	1,737,170	34,467.22	5.04***
poorroad	-245,870,000	56,788	6.47
bokeo	-2,714,510	40,1169.3	-6.77***
luangnamtha	-1,769,389	334,835.1	-5.28***
constant	1,088,039	557,412.7	1.95*
Inverse Mill Ratio (athrho)	**183,684**	**1,416.471**	**0.01**
Selection equation			
Dependent variable: dummy for participate on contract farming (dummycf)			
prop_adult	-0.0475527	0.0190332	-2.50**
male	-0.1876979	0.1554854	-1.21
edu_3	-0.0334971	0.0277566	-1.21
monekhmer	0.1685773	0.1174309	1.44
hmonglu	-0.0648793	0.1278063	-0.51
tibetchn	0.3721741	0.1017278	3.66***
prop_irr	-0.4578943	0.0030205	2.34***
farmsize	0.1173945	0.0246472	4.76***
debt	-0.2015606	0.0809449	-2.49**
poorroad	-0.0270482	0.035183	-0.77
dt_province	-0.010122	0.0010715	-9.45***
dt_mkt	-0.0001005	0.0004387	-0.23
bokeo	-0.7598377	0.124546	-6.10***
luangnamtha	-0.6134004	0.1016303	-6.04***
constant	0.387361	0.1801576	2.15**

Note: Standard errors are in the parentheses; *** indicates the significance at the 1% level, ** indicates the significance at the 5% level, and * indicates the significance at the 10% leve

Appendix E

Factors that affect households' farm production and income among contract and non-contract farming groups

Figure E.1 showed factors that affect households' farm production and income among contract and non-contract farming groups as following:

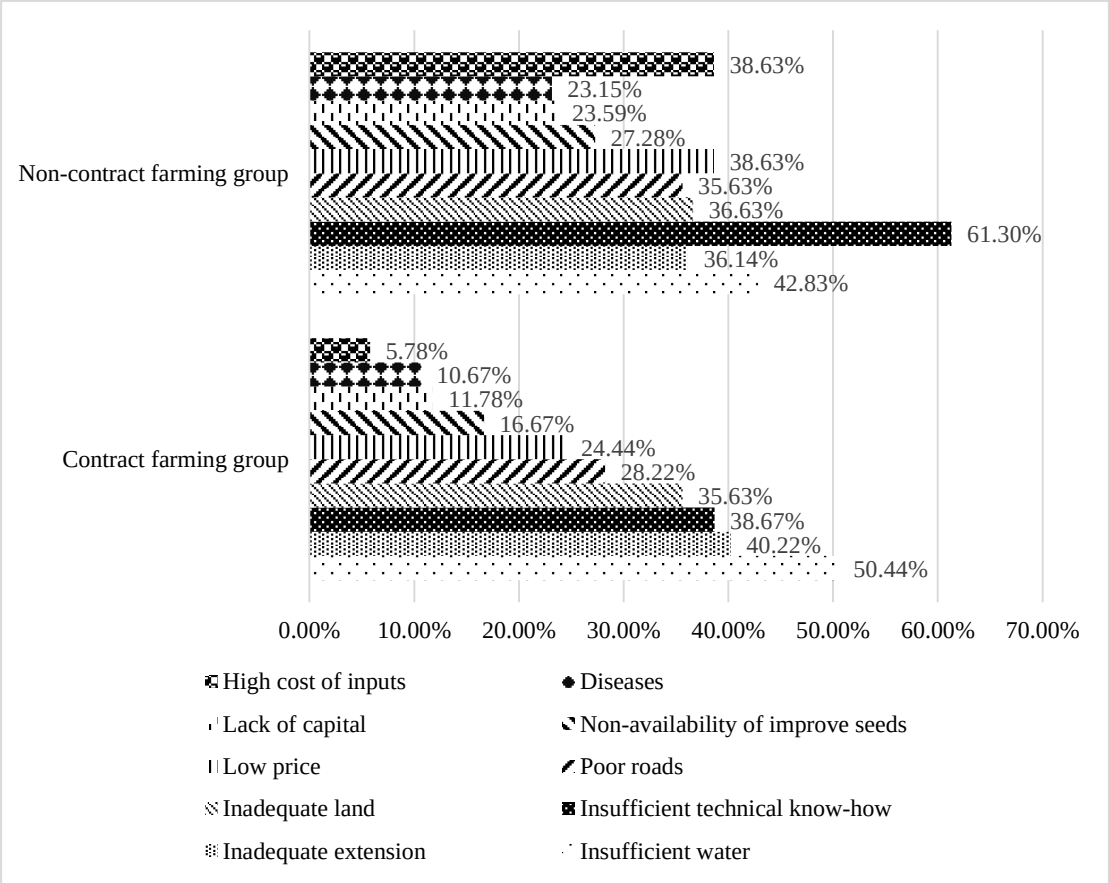

Figure E.1 Factors that affect households' farm production and income among contract and non-contract farming groups

Source: AGRONOMY-SOCIOECONOMIC SURVEY QUESTIONNAIRE, Household Agro-Socio-Economic Survey, questions number 15

Appendix F

Questionnaire

The agronomy-socioeconomic survey questionnaire was separated into two parts: household and village agronomy-socioeconomic survey.

LAO PEOPLES DEMOCRATIC REPUBLIC

PEACE INDEPENDENCE DEMOCRACY UNITY PROSPERITY

MINISTRY OF AGRICULTURE AND FORESTRY

DEPARTMENT OF PLANNING

Northern Rural infrastructure Development Sector Project

ADB Grant No. 0235-Laos

October 2011

AGRONOMY-SOCIOECONOMIC SURVEY QUESTIONAIRE
Household Agro-Socio-Economic Survey

Subproject: _____ Interview Code Number: _____

Village: _____ District: _____ Province: _____

Interviewer: _____

Date (day/month/year): _____

I. General Information

1. Name of husband: _____ Ethnic group _____ Religion _____
2. Name of wife: _____ Ethnic group _____ Religion _____
3. Number of families in the household: _____ Members: _____ Religion _____
4. Land own area _____

II. Health

5. In case of sickness, where do the household members go?

Place/Person		(Please tick in the list below)	Reasons such is done/selected as preference
1)	Self-Medication		
2)	Traditional Doctor		
3)	Dispensary		

4)	Pharmacy		
5)	Public Doctor		
6)	Private Doctor		
7)	Public Clinic/Hospital		
8)	Government Clinic/Hospital		
9)	Other Crops		

III. Household Income

6. Farm Income (Net)

Items		**Gross Revenue, Production Cost and Net Income in Kips/Year**								
		2008			**2009**			**2010**		
		Revenue	**Cost**	**Net Income**	**Revenue**	**Cost**	**Net Income**	**Revenue**	**Cost**	**Net Income**
Income from their own farm										
1)	Rice									
2)	Banana									
2)	Rubber tree									
3)	Livestock, Poultry									
4)	Income from contract farming									
5)	Other crops									

6)	Being hired labor from other farm in village or nearby villages									
7)	Sales of non-timber forest products									
Total										

7. <u>Non-Farm Income (Net)</u>

Items	**2008**	**2009**	**2010**
1) Labor outside farm and village (construction, carpentry….)			
2) Salary as an employee (private or government)			
3) Sales of handicrafts/hand woven materials			
4) Business (retail shop, food shop, trading, buy and sale, etc.)			
5) Others (Money from relatives abroad, etc.)			
Total			

IV. Family Expenditures

8. Household expenses

Items		2008	2009	2010
1)	Rice and other food stuff			
2)	Education			
3)	Clothes			
4)	Medical/health			
5)	House repair; improvements, home furnishing			
6)	Electricity and fuel for lights and cooking			
7)	Transportation (fares, vehicle maintenance of if any, fuel and oil, etc.)			
8)	Social events and entertainments (wedding gifts, birthdays, donations, movies, family outing, celebrations, etc.)			
9)	Miscellaneous/other Expenses			

V. Male and Female Work Distribution

Work/Responsibility		Please tick		Please tick		
a	Financial budgeting and management		Male		Female	***Note: If not the responsibility or work of a gender leave blank opposite the gender.***
b	Money earner		Male		Female	
c	Keeper of household money		Male		Female	
d	Marketing		Male		Female	
e	Child rearing		Male		Female	

f	Cooking		Male		Female
g	Washing clothes/dishwashing		Male		Female
h	Cleaning the house		Male		Female
i	House repair/construction		Male		Female
j	Fuel wood gathering		Male		Female
k.	Fetching water		Male		Female

10. Agriculture and Business **(Check opposite applicable gender)**

	Work/Responsibility	Please tick		Please tick		
a	Land preparation		Male		Female	***Note: If not the responsibility or work of a gender leave blank opposite the gender.***
b	Irrigation		Male		Female	
c	Buying inputs		Male		Female	
d	Seed Sowing/Nursery		Male		Female	
e	Pulling seedlings		Male		Female	
f	Planting/Transplanting		Male		Female	
g	Weeding		Male		Female	
h	Fertilizer application		Male		Female	
i	Pesticide/Herbicide Application		Male		Female	
j	Harvesting		Male		Female	
k	Threshing		Male		Female	
l	Hauling/Transport		Male		Female	

m	Drying		Male		Female
n	Milling		Male		Female
o	Livestock Management		Male		Female
p	Poultry Management		Male		Female
q	Fish Pond Management		Male		Female
r	Selling production		Male		Female
s	Business (store, buy and sell, trading, etc.)		Male		Female

11. Decision-Making Responsibilities

	Work/Responsibility	Please tick in the box		Please tick in the box	
a	Budget allocation/utilization		Male		Female
b	Education of children		Male		Female
c	Crops to plant		Male		Female
d	Livestock to raise		Male		Female
e	Equipment to buy		Male		Female
F	Home appliances to buy		Male		Female

VI. Crop Production Technology

12. What types of paddy rice seeds you use? ***(Please tick in the box, possible to select both)***

1)		Local variety	2)		Improved variety

13. Do you get any advice on the use of improved varieties of seeds and fertilizers? ***(Tick in the box)***

1)		Yes	2)		No

14. If yes, where do you get the advice or information about new technologies ***(Tick in the box)***

1)	District Agriculture and Forestry Office Staff (DAFO)	4)		Village authorities
2)	Private agricultural companies	5)		Others
3)	Farmers practicing improved technology			

15. What are the reasons affecting your farm production and income? **(Please tick in the box)**

1)		Inadequate land
2)		Rainfall limitation or lack of water during dry season
3)		Poor soils and topography
4)		Poor transportation/roads
5)		Depressed prices of farm products
6)		Poor communication with extension agents
7)		Lack of working capital to buy new inputs
8)		Insufficient technical know-how
9)		Diseases

10)		High cost of inputs

16. Are you willing to change your present farm technology?

1)		Yes	***(Please tick in the box)***
2)		No	

17. How do you like to learn new/improved technologies? ***(Please tick in the box)***

1)		Establish village demonstration center	5)	Through contract growing scheme
2)		Teach-ins through farmer leaders	6)	Through group farming
3)		Teach-ins through District Agriculture and Forestry Office Staff (DAFO) extension agents	7)	Others
4)		Study tour and cross visits to model farms		

18. Are you aware or do you understand better farming technologies for upland and rearing livestock?

Please tick appropriate box						**Suggestions for improving farming technologies**
1)	Upland		Yes		No	
2)	Livestock		Yes		No	

19. Do you have knowledge of pre and post-harvest losses, mitigation measures, pest-free storage, drying and seed multiplication of grain crops? ***(Please tick in the box)***

Knowledge	Yes
Pre-harvest and post-harvest loss mitigation measures	
Pest-free storage	
Drying	
Seed multiplication of grain crops	

VII. Credit

20. Did you ever borrow money to finance acquisition of farm inputs?

1)		Yes	***(Please tick in the box)***
2)		No	

1)	Borrowed Amount (Kip)	
2)	Interest (percent)	
3)	Borrowed Period (month)	
4)	Source of Borrowing	

VIII. Response to the Proposed Subproject

22. Does the household support the project? ☐ Yes ☐ No

23. Perceived benefits from the subproject to the household

Benefit (List from the most important benefit to the least important benefit)

24. Perceived negative impacts of the subproject to the household

Impact	**Suggest Mitigation Measure**

AGRONOMY-SOCIOECONOMIC SURVEY QUESTIONNAIRE

Village Agro-Socio-Economic Survey

Subproject: ……Interview Code Number: ……..

Village: ……District: …….. Province:……

Interviewer: …… Date (day/month/year):……...

I. General Information

1. Village Establishment: Year ☐

2. Village Structure:

Positions	Female	Male		
1) Village Chief				
2) Deputy village chief- 1				
3) Deputy village chief- 2				
4) Head and members of village committees	Head/Chief (Tick in the box if make or female)		Committee Members	
	Female	Male	Female	Male
a) Lao National Front or Senior Citizen				
b) Lao Women Union				
c) Village Security				
d) Village Army				
e) Youth				

3. Existing groups and peoples' organization in the village

Name of Group or Organization	Head/Chief ("Huana")			Executive Committee ("Kanakamakan")			Members ("Samasik")		
	Female,*/	Male,*/	Total	Female,*/	Male,*/	Total	Female,*/	Male,*/	Total

Note: */ stand for Tick in the box if male or female

4. Total households, families and population in the village

Name of Village	Numbers of households	Number of family members in household	Population			Available Labor in Village (18 years old and above)			Religion
			Female	Male	Total	Female	Male	Total	

5. Migration Patterns for the last three years

a) In-Migration (People who came to live/reside in the village)

Name of Village	2008			2009			2010		
	Number of family members in household			Number of family members in household			Number of family members		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
Total									

What are the reasons for In-Migration? ……

……..

b) Out-Migration (People who left the village to live/reside in another place)

Name of Village	2008			2009			2010		
	Number of family members in household			Number of family members in household			Number of family members		
	Female	Male	Total	Female	Male	Total	Female	Male	Total
Total									

What are the reasons for Out-Migration? ……

……

……

6. Vulnerable Groups

Name of village	Female Headed Households		Female Headed HH With No Lands		Poor Female Headed	
	Number of households	Number of family members in household	Number of households	Number of family members in household	Number of households	Number of family members in household
Total						

Name of Village	Total Poor household in the Village (Below Poverty Line)		Landless Households	
	Number of households	Number of family members in household	Number of households	Number of family members in household

Note: Poor or low income household means household income is below poverty line (75,000 Kip/month/number of members in household in 2012)

What assistance and support are given or planned/done by the government to women-headed, landless and poor households?.....

……..

What are the sources of income of female headed households?.....

……

What are the sources of income of landless households?.....

…….....

7. Children are going to school

a) Primary to Secondary or High School

Name of village	Primary to Elementary School Age Children			Children Actually Going to School		
	No.of Female	No.of male	Total	No.of Female	No.of male	Total
Total						

b) College/University

Name of village	Primary to Elementary School Age Children			Children Actually Going to School		
	No.of Female	No.of male	Total	No.of Female	No.of male	Total
Total						

8. Literacy situation (Number of adult people, adult people means people who had age equal to or greater than 18 years old, who can read and write the Lao National language)

Name of village	Literate Population		
	No.of Female	No.of Male	Total
Total			

9. Technical skills available within the village

Items		Number/Persons
1)	Teachers	
2)	Doctor/Medicine/Primary Health Care	
3)	Construction	
4)	Irrigation	
5)	Agriculture	
6)	Veterinary	
7)	Forestry	
8)	Carpentry	
9)	Handicraft (weaving, furniture, etc.)	
10)	Masonry	

10. Occupation of People in the Village

Items		No.of households	No.of male	No.of female	Remarks
Agriculture Occupation					
1)	Agricultural Crop Production				
2)	Livestock Production				
3)	Poultry Production				
4)	Fish Production (Fish Ponds)				
Occupation of Outside Farm		No.of households	No.of male	No.of female	Remarks
1)	Employment (private and government)				
2)	Business (sales, food shop, repair shop, etc.)				
3)	Handicraft (weaving, furniture marking, etc.)				
4)	Farm Labor (hired by other farmers)				
	Labor outside farm and village (off-farm labor such as carpentry, labor for construction, etc.)				

What do households do or work when not busy in farming activities: (after transplanting or before harvesting or when dry season crop is not

planted)?.....

.....

.....

.....

III. Village facilities/Infrastructures/Equipment

11. Does the village have the following facilities?

Items			Please tick if available	Describe Status (usable; not usable; good condition; or need repair)
1)	Village Access Road			
2)	Primary school			
3)	Elementary school			
4)	High school			
5)	Domestic water supply			
6)	Dispensary/Health Clinic/Hospital			
7)	Post office			
8)	Market			
9)	Electricity			
10)	Temple			
11)	Telephone	a) Land line		
		b) Mobile cell site coverage		

12. Accessibility

Place		Distance, (kilometer)	Name of road, types and status	Available Transport
1)	Village to district officer			
2)	Village to provincial officer			
3)	Nearest main/paved road			
4)	Access to nearest education facilities			
	Primary School			
	Elementary School			
	High School			

	Vocational School			
	College/University			
5)	Access to nearest health facilities			
	Pharmacy			
	Dispensary			
	Health clinic			
	Hospital			

13. Accessible markets for agricultural products

Market Name/Location		Distance, (km)	Name of road, type and status	Available Transport
1)				
2)				
3)				
4)				
5)				

14. Equipment owned by households

Equipment		Total No. of Units	Household owning
1)	4-Wheeled tractors		
2)	2-Wheeled tractors		
3)	Threshers		
4)	Rice mills		
5)	Car/Pick-up		
6)	Trucks		
7)	Tricycles (tuktuk, jumbo)		
8)	Television		
9)	Refrigerator		
10)	Water pump for house		

11)	Water pump for farm		

15. Types of houses in the village

Types of house		No.of household
1)	Type1: Houses purely made of bamboo, wood, roof of grasses and other local materials	
2)	Type 2: Houses made of combination of concrete, wood, bamboo, and grass/iron roofing	
3)	Type 3: Modern houses made of concrete and iron or tile roofing	

III. <u>Health Issue</u>

16. Source of drinking water (some households maybe getting water from more than one source)

Items		Number of Households	Average distance from house (meter)
1)	Village domestic water supply		
2)	Hand pump ("nammadan")		
3)	Open well		
4)	River, stream, spring		
5)	Irrigation canal		

17. Sanitary latrines/toilets

1) Households/families with latrines (toilets) [ ] Households [ ] Families
2) Village Public Toilet [ ] Toilets

IV. Agro-Economic

18. Household owned and and cultivated agricultural lands (Note: These data must be taken from and the same with area in Master list of Villagers)

Particulars		Total Area (hectare)	No. of household	Type of documents for land ownership			
				Land Title Ownership "bai yang yeun kammasit ti din"		Right to Use - "bai pasi ti din"	
				HW*	Name(s) in Document	HW*	Name(s) in Document
1)	Irrigated Lowland - "na tee hap nam sonlapathan"						
2)	Rainfed Lowland - "na tee hap nam fon"						
3)	Upland - "neun soung", "na hai", "na peut"						
4)	Home garden - "suan koua"						
Particulars		Total Area (hectare)	No. of household	Type of documents for land ownership			
				Land Title Ownership "bai yang yeun kammasit ti din"		Right to Use - "bai pasi ti din"	
				HW*	Name(s) in Document	HW*	Name(s) in Document
5)	Fish pond - "Nong Pa"						
6)	Fruit trees - "suan ton mai hay mak"						
7)	Trees for Lumber/wood - "suan pohk mai"						
Total							

Note: *Name(s) in Document can be answered by H = "head of family or husband only" or H and W "both husband and wife"

19. Crops grown by villagers during wet seasons

Crops		Number of household	Total Area (hectare)	Total Production (ton)	Average Yield (ton/hectare)
1)	Irrigated rice				
2)	Rainfed rice				
3)	Upland				

20. Crops grown by villagers during dry season

Crops		Number of household (hectare)	Total Area (ton)	Total Production (ton/hectare)	Average Yield
1)	Irrigated rice				
2)	Rainfed rice				
3)	Upland rice				

21. Rice Production for the last three years

Crop year	Wet Season			Dry Season			Total Production, tons
	Area	Production, tons	Average Yield (tons/hectare)	Area	Production, tons	Average Yield (tons/hectare)	
2008							
2009							
2010							

22. Rice Sufficiency Situation for the last three years

Situation		Number of households
1)	With surplus rice	
2)	Rice sufficient families (0 surplus 0 deficit)	
3)	Less than 1 month deficit	
4)	1 - 2 months deficit	
5)	More than 2 to 3 months deficit	
6)	More than 3 to 4 months deficit	
7)	More than 4 months deficit	

23. Livestock Production

Livestock		No.of heads	No.of households
1)	Buffaloes		
2)	Cattle		
3)	Pig		
4)	Goat		

24. Poultry Production

Poultry		No. of heads	No. of household
1)	Chicken		
2)	Duck		
3)	Turkey		

25. Fish Production

Fish		Area (hectare)	No. of household
1)	Fish pond		
2)	Rice-Fish culture		

26. Price and Buyers of crops in the Village in crop in 2010

Crops		Price of crops in kips/kilogram		Buyers of Crops Produced by Farmers in the Village				
		2010		Village Trader/Market	Traders from Outside Village	Contract Farming	Markets Outside Village	Others:
		Wet	Dry					
1)	Rice							
2)	Corn							
3)	Cucumber							
4)	Cabbage							
5)	Chicken							
6)	Duck							
7)	Pig							
8)	Cattle							
9)	Carabobo							
10)	Goat							

V. **Problems and Issue**

27. List problems/issue of people in the village

Agriculture	
Problems/Issues	Suggested Mitigation Measure
Health	
Problems/Issues	Suggested Mitigation Measure

Others	
Problems/Issues	Suggested Mitigation Measure

VI. Village Response to the Proposed Subproject

28. Potential beneficiaries of the subproject

Village		**Total Potential Beneficiaries**		**Female-Headed Households**		Remarks
		No. of household	**No. of family members in household Members**	**No. of household**	**No. of family members in household Members**	
1)						
2)						
3)						
4)						
Total						

29. Does the village support the subproject? ☐ Yes ☐ No

30. Perceived benefits from the project

Benefits (List the most important to least important)

31. Perceived negative impacts of the project

Impacts	Suggested Mitigation Measure

BIOGRAPHY

NAME	Miss Chindalath Phommanilath
ACADEMIC BACKGROUND	Bachelor' degree with a major Economics Applied from The Faculty of Economics and Business Management at National University of Laos, Vientiane capital, Lao People Democratic Republic, from 2009 to 2014.
PRESENT POSITION	Student at Graduate School of Development Economics, National Institute of Development Administration.